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EDITORIAL

Five Thousand Freedoms

TAKING an over-all look at the current press of events, one notes that perhaps the most important of all the signs pointing to better days is the fact that the emergency of war has dissipated innumerable inertias, each an interruptant of progress."

This sentence was picked out as the most significant and inspiring by H. B. Walker, president of the American Society of Agricultural Engineers, from all the wealth of vision embodied in an address before the recent meeting of the American Chemical Society at Buffalo, N. Y., by Dr. Charles M. A. Stine, vice-president of E. I. du Pont de Nemours and Co. A single example of such a dissipated inertia, one that concerns our farm structures engineers, may be quoted: "Prefabricated sections which can be easily handled by two men . . . new insulating materials, making possible light walls that will be several times as efficient as heavy masonry . . . plywood, plastics . . . stainless steel as a common roofing material of the future."

In his peroration Dr. Stine referred to the four freedoms so eloquently put forward by President Roosevelt, and the fifth freedom which his practical predecessor has added as "also mandatory in the victory—freedom of economic enterprise." Not only for these five, but for five hundred, yes, for five thousand other freedoms does the scientist fight, some of them summed up by Dr. Stine as:

"The freedom to work, to expand the intellect, to worry through with a theory until it is validated or disproved; the freedom to banish the wasteful and enthrone the efficient; the freedom to improve, if he can, everything that exists under the sun, and beyond that to create things upon which the sun has never before shone."

We commend the entire address as worthy reading.

(EDITOR'S NOTE: Printed copies of Dr. Stine's address in full may be obtained on request to L. F. Livingston, manager of Du Pont's agricultural extension division, 8120 Du Pont Bldg., Wilmington, Del.)

Milk Tide Turns Ebb

IN AMERICA'S foremost dairy state, milk production increased through 1941 and part of 1942, then began to decline. On the St. Paul market, in the adjoining state, one-half the cattle during a recent week consisted of dairy cows. In the same state, farm sales are occurring at 250 per cent of the normal rate. All are symptoms of a disastrous trend, due largely to short-sighted if not actually misguided manpower policies, according to the farmers themselves and to agricultural observers.

Second only to the shortage of competent labor is the shortage of farm machinery, according to these same informants, who are on the ground, not in Washington. A single example will illustrate how desperate is the dearth.

On July 4th of this year a Wisconsin farmer was electrocuted while putting up a flag. A few weeks ago there was an auction sale of his farm stock and equipment. His binder brought $70 more than it cost new 22 years ago. A grain drill for which he paid $60 thirty years ago was sold for $67.50. His hay loader brought $240. The purchasers, be it pointed out, had neither the blandishments of salesmen nor the lure of new lines and shiny paint to tempt them. The automotive theory of farm machinery buying, even if it were true, would not apply.

While farmers and farm economists have some sense of the part played by machines in food production, past and present, only the trained agricultural engineer knows the extent to which machinery could be, and should be, multiplying manpower and making up for the shortage of farm help. In times past we encouraged the use of machinery to enhance the estate of agriculture. Now we must proclaim the expanded application of machines as a patriotic measure, that the forces of freedom may have food.

Figures from the Food Front

IN THE business of fighting a war, food is not second to any other item . . . Every pound of food that America can produce is going to be needed. We need it and the world needs it." So said Colonel Paul Logan, assistant chief of the Subsistence Division, Quartermaster Corps, in an address to representatives of the dehydration industry, according to "Science News Letter" for October 17.

But what of the wherewithal to produce that food? A little later in the month, press reports from Washington stated that quotas at long last had been fixed for manufacture of farm machinery and repair parts. Expressed in terms of 1940 production, the figure for new machines is to be 23 per cent, and for repairs 130 per cent. Without knowing exactly the ratio of material for new machines and repairs in 1940, it seems safe to estimate that the total tonnage for farm machinery, new and old, for 1943 will be around 34 per cent of the 1940 tonnage.

Assuming that the steel industry is able to continue operating at the rate of 85 million tons a year, it would take a trifle less than 1½ per cent of current steel production to build a full 100 per cent of the 1940 rate. The quotas lately announced therefore will take about one-half of one per cent of our steel supply.

Published quotas for individual machines would allow a new two-row horse-drawn planter for 18,500 acres of corn, a new mower for 4,700 acres of hay, and a new tractor for each 160 farms. On the basis of present tractor population and a uniform rate of replacement, it would require tractors to have a useful life of about 40 years.

In the face of those figures, it seems hardly possible to offset the mortality of farm machines with repair parts only 30 per cent more plentiful than in 1940. Farmers and implement dealers will need to be magicians.

Serfs in Sight

SERFDOM is a form of involuntary servitude wherein men are bound, not to a personal master, but to the soil. Serfdom was abolished in England centuries ago, and in Russia generations ago. Now it is proposed to be introduced into America in the guise of war necessity.

According to reliable reports from the grass roots, inductions and enlistments are to blame for but a small part of the man power shortage in agriculture. Most of the trouble is due to the draining away of farm help into industrial employment, caused mainly by inflationary wage pressures which apparently have been resisted only feebly. This encouraging of inequity and then freezing it can well be called economic gerrymandering.

For all the years of its life as an organized profession agricultural engineering has sought to multiply the productivity of farm labor so that it might enjoy economic equality and still provide abundant food at low cost. In the more efficient types and areas of farming that goal was well-nigh attained. Agricultural engineers will question the necessity and shudder at the prospect of serfdom under any name.

AGRICULTURAL ENGINEERING

VOL. 23 NOVEMBER 1942 NO. 11

Wartime Prices as Related to the Work of Agricultural Engineers

By R. B. Corbett

THIS IS the second installment of a continued story. I am certain that this second installment will not be the last.

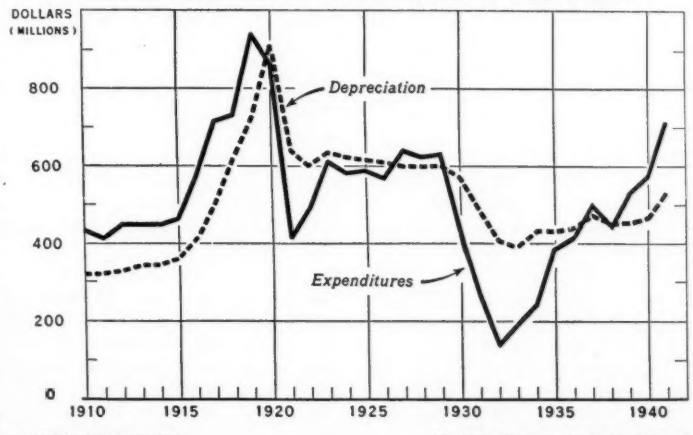
Some of you will recall the paper, entitled "Agriculture's Big Building Job," presented by A. V. Krewatch and R. W. Carpenter* before the 1941 meeting of the North Atlantic Section of A.S.A.E. It showed the value of homes and buildings on the farms of the United States as 6⅓ billion dollars in 1910, a great increase to 11½ billions in 1920, a further increase to 13 billions in 1930, and a sharp decrease to 10½ billions in 1940. Also a chart (reproduced on this page) was shown which gave the trend of depreciation of and expenditure for farm buildings, fences, windmills, and wells from 1910 until 1940. From 1910 to 1915 depreciation averaged a little more than 300 million dollars per year. At the same time expenditures on the farm investment averaged between 400 and 500 million dollars per year. In the next five years, the full effect of the war on prices was shown, and expenditures went from approximately 500 million dollars a year to a peak of over 900 million a year. Depreciation was less than this, but did reach a peak of about 900 million dollars in 1920. Then came a break in the price level. Expenditures dropped back to 400 million a year, but depreciation remained above 600 million a year. With the exception of the short period from 1926 to 1929, expenditures from that time until just recently have been less than depreciation. Mr. Carpenter and Mr. Krewatch pointed out that it is an unhealthy situation, when a great industry involving more than a quarter of our entire population is unable to maintain its physical plant.

During the discussion period which followed the reading of that paper, I called attention to the great similarity between the trend of the lines of depreciation and expenditures and the trend of the so-called "general price level." A further statement was made that so many factors were influenced by the trend of the general price level that it would seem wise to analyze that price level in light of this problem. The second chart (reproduced on the following page) gives the general price level over a long period of years. From 1910 until 1940 it is evident that the same factors dominated the trends of all three of the lines discussed. You will agree that the similarity is so striking that there can be no question about the same forces affecting all three. When three trends are so nearly identical over a thirty-year period, certainly the same forces have been at work.

Let's analyze this general price level and see what it means to you, to me, and to all people in the United States, but particularly what it means to you as agricultural engineers. The summation of virtually all our price facts can be found in what has become known as this general price level; it is made up of about eight hundred different prices. Between any two periods some of these prices may be rising, others may stay at the same level, and still others may be falling. All of these diverse tendencies are brought together in the one line on the chart. The more important factors have the greatest influence upon the direction of the line. For example, the price of wheat affects the line more than does the price of rye because we have more wheat in the United States. The years 1910-14 are called the base years and everything is compared with them. The average of these prices for the years 1910-14 is 100. These years are chosen since they were the last years before the first World War, and things were felt to be as nearly normal as any recent five years that can be found. If one knows enough about prices, this line virtually tells the economic history of the United States.

Go back for a moment more than 140 years to the point where we have the earliest data on prices. At that time prices were high as compared with 1910-14. About 1812 prices began to rise with tremendous rapidity, reached a peak of 80 per cent above the base period, then crashed downward, hesitated a while, and then fell again. There is some very interesting history

EXPENDITURES FOR AND DEPRECIATION OF FARM BUILDINGS, FENCES, WINDMILLS, AND WELLS, UNITED STATES, 1910-41

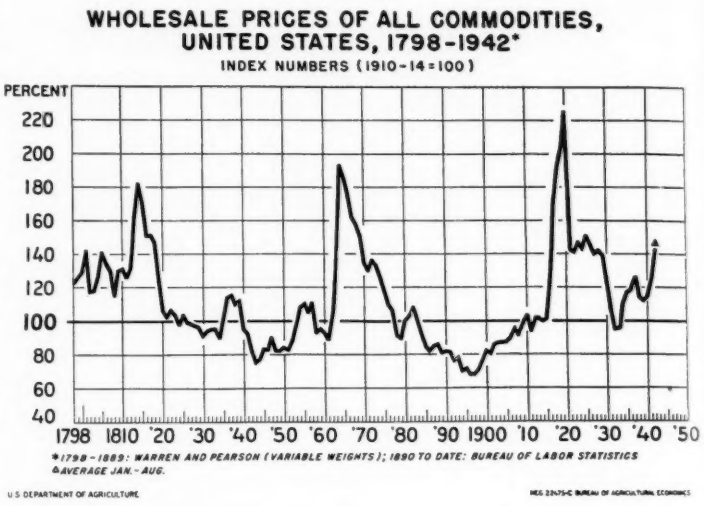


U. S. DEPARTMENT OF AGRICULTURE NEG. 39015 BUREAU OF AGRICULTURAL ECONOMICS

Paper presented September 29, 1942, at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at New York City. Author: Director, Maryland Agricultural Experiment Station.

*See page 344 of this issue for the paper in abridged form.

reflected in the prices between 1820 and 1860, but attention will be given only to the major changes in price level. In 1861 prices again began to rise with tremendous rapidity, reached a peak of nearly 100 per cent above the base, came crashing downward, hesitated a while, and then fell again during that famous depression of the seventies. After a brief period of relief they continued downward into the depression of the nineties, when grain was burned for fuel on farms, the whole country was talking silver and prices, and the nation was in one of its most serious periods. In 1896 a period of rising prices began, and during this upward trend much of our conversation centered around the high cost of living. "Go back to the farm" and other similar slogans which encouraged agricultural production were in vogue. About 1916 prices again began to rise with tremendous rapidity, reached a peak of approximately 220, crashed in 1921, then hesitated for the period of the twenties, which we now look upon as the days of prosperity, and crashed again as we experienced the depression of the nineteen thirties.



These great changes in price affect all human relationships. You and I are definitely affected by such shifts in price. Here are a few illustrations from actual experience.

In 1919 a Middle West city was discussing one man. He was president of the largest company in that city, and the city was proud of him. It was said on the streets that he had started with nothing and at that time was worth 91 millions of dollars, and the people always put on the one million. He was a business success, an industrial hero. In 1921 he was thrown out of the company. He was no less a great man in 1921 than he had been in 1919, but it was one thing for a great corporation to buy raw materials, hold them while they were being processed, and then sell them on a much higher price level than when they were purchased. It was another thing for a great corporation to have huge inventories purchased at a high price level, hold them while they were being processed, and then sell on a much lower price level. Everything in the one situation makes for profits. Everything in the other situation makes for losses. An illustration of the rise and fall of an industrial giant through a change in price level.

In the late twenties a group of us sat at a dinner table in Providence, Rhode Island. The speaker was the one person who was not a native of the state. The other three were all graduates of Rhode Island State College, but did not know it until the conversation had gone on for some time. Then, as we all do, they began checking on whom they knew in common. They talked about this person and that person and finally came to the name of a girl whom they described something like this: What a live, vivacious, optimistic person she had been while in college. A leader, a person that everyone liked to be with, but how life had changed her. They described her as old, disappointed, almost broken, and discouraged. I could not help but ask about her history. It seemed that this girl had married a boy from Rhode Island State College in the class which followed her class. They had a small inheritance. They went into the Connecticut Valley, which is an excellent farming region, and bought what was apparently a good farm, putting all their equity into this farm. They did this in 1919. In 1921 came the great crash in prices (as shown by the chart). Their equity was wiped out. They could not meet their bills with the falling prices of agricultural products. They lost everything and had to start anew in a much worse position than they were at the outset. The financial crash of a young couple on a farm due to a change in prices over which they as individuals had no control. An illustration from agriculture of the effect of a change in price level.

In one of the eastern states, a financial and political boss used to boast of the amount of money he had made during his lifetime. To be sure, he had inherited a fortune, but he was proud of the way he had increased it. One of the unusual things about him was his continual boast that he had never gone to school and that education was unimportant in a man's success. This made him more interesting to many people so that he was given much publicity. At one time a statement was made as to what he had inherited in the late nineties and what he was worth just prior to the crash in prices in 1929. If one was to apply the general rise in prices as indicated by the general price level (from which anyone who had a diversity of holdings would have benefited), or, to say it another way, if this rise had been fully discounted, instead of increasing the fortune, he had added approximately five per cent per year to what he had inherited. This was just interest on his capital. The rest of his greatness was due to the change in general price level. To prove this, in the depression of the thirties his political power was broken. He no longer boasted of the additions he had made to his fortune. In fact, since the early thirties little has been heard of him. An illustration from political and financial life which indicates that an individual was made and then broken by the change in price level.

And, finally, the story of three brothers who started farming. The first started about 1890, failed, and became a hired man. The second started about 1892, failed, and became a hired man. The other took his share of the estate and started in 1896, and was a real success. The neighbors all agreed that they had expected the youngest boy to be more successful—he was more like his father. It happens that this youngest boy became a great student of prices during the latter part of his life, and he laughed at the explanation that he was superior in ability to his brothers. He simply said, "I was born at the right time." He pointed out that his brothers started farming when prices were falling, and as quickly as they made an investment it was virtually wiped out by the fall in price. He was lucky enough to make his start in a year when prices began to rise, and

every move he made was helped by the increase in prices, and it was easy for him to be successful.

I hope that this description and these four illustrations have driven home to you the fact that changes in the general price level affect everyone. If you are on a fixed salary, they affect you tremendously; if you are in business they affect you tremendously; if you are living on an income from stocks and bonds, they affect you tremendously; and so it is intelligent for us to spend some time analyzing the general price level.

I think you will agree that the movement of the general price level is the dominant factor in farmers deciding whether or not they could and would make expenditures for improvements to their buildings, and thus whether or not depreciation exceeded the outlays for upkeep. If these seem like correct statements to you, then the all-important thing is what happens to this general price level in the future. Will history repeat itself and during this war prices go to a great peak with accompanying outlays for physical equipment, this peak to be followed by a great drop in prices, then a period of relative prosperity while we make up for the production deficits accumulated during the war, and then a serious period of depression? This question, to me, is second only in importance to the actual winning of the war. I seem to take it for granted that we are going to win this war. I believe all Americans do. I am more disturbed about the after-effects than I am our military victory. I see the possibility of losing all of that for which we are fighting in the post-war period. This assumes that the two main factors for which we are fighting are the freedoms which accompany democracy and the freedoms of individual economic enterprise. It is entirely possible that these two freedoms may be completely eliminated in our attempt to meet a post-war depression. This to me is a staggering thought and one in which every intelligent American must be interested.

A REAL CHALLENGE AND RESPONSIBILITY IS PRESENTED TO AGRICULTURAL ENGINEERS

In agriculture no group can do more to prevent such an occurrence than the agricultural engineers. Thus you have a very real challenge and responsibility. Before talking about what you can do, let's look into the future and make the best forecast we can of what will happen to this general price level. We are doing several things to see to it that history does not repeat itself. The Emergency Price Act passed a number of months ago is the most far-reaching economic law the United States has ever had. Its primary purpose is to stop the rise in prices during the war period, such as occurred in the three major wars since we became a nation. We are at the present time engrossed in a great controversy as to how this control can be administered and as to what is fair among various groups, particularly agriculture and labor. I shall not get into that controversy. I shall point out to you that it is a fact that the Price Administrator has had for a number of months the legal right to set ceilings on a number of agricultural products, and he has failed to do so. I believe the chief reason for this failure has been the fear that any price ceilings set on agricultural products, which would be relatively low as compared with wages of labor, would so curtail production that the Administration could not afford to invoke the powers that has been given it. It is my belief that we are going to have production, and if price control gets in the way of production, production will win. It is my belief that unless we stop dilly-dallying with the wages of labor and definitely control them since they are the major factor in almost all costs, our whole attempt at price control will be a dismal failure. So far there is nothing in the picture which would indicate that we are seriously going to control wages. The new action by Congress may be the forerunner of such an attempt, but if not, there remains the open question whether any power can adequately control price levels.

The best forecast that you and I can make at this time is that prices will continue to rise, that they will go to somewhere near the peaks of the last war, and then we can expect drastic declines in the future. One of the things which must be met if our social and economic system is to survive is the employment of the people who are now in the armed forces or who are now working in industry directly connected with our war effort, making guns, tanks, airplanes, etc. It is not a far-fetched forecast to say that 75 per cent of all the gainfully employed in the nation will be in the military forces or in work directly connected with the military effort. Think of the gigantic employment problem which is going to accompany the adjustment from such a situation. We must be prepared to meet these problems if we are to maintain our social and economic structure, and this is where we return to the place of the agricultural engineers in this price problem.

AGRICULTURAL ENGINEERS AND MANUFACTURERS CAN PREPARE NOW FOR POST-WAR PERIOD

At the University of Maryland, the agricultural engineering department has recently developed a new piece of agricultural equipment. We attempted to interest several firms in this equipment, and the typical answer was that we are at war, men are not available, materials cannot be obtained; there is nothing we can do until this war is over. It was a rather discouraging situation. Then out of the blue, the vice-president of a large engineering corporation came to my office. He said, "We can get priorities on material for research. We think it is tremendously important that we have work ready to be done when this war is over. We have a piece of household equipment that will do several things that none of the available types of equipment will do. The experimental work is done and the plans are all made to go into tooling just as soon as men and materials are available." And he stressed the contribution which they, as a business corporation, could make to the post-war period. He then stated that he wanted to work with our new piece of equipment on the same basis. His plan was to cooperate with us in getting our new piece of equipment into the position where manufacture could be started as soon as men were looking for work and materials were available. He was a man with vision. This is an illustration of the type of thing that engineers can do.

Now let us return to the thesis of Carpenter and Krewatch. In their paper of last year, they pointed out that only one farm home in three had either running water or a water pump; that only one farm home in four had electricity; that only one farm home in ten had an indoor toilet; and that only one farm home in ten had central heat. They pointed out that normal depreciation of the agricultural plant must be offset, that twenty years' accumulated deficiency in maintenance must be made up, that substandard homes and buildings must be modernized, remodeled, or replaced. The program which they contemplate involves billions of dollars. It is big enough and far-reaching enough to really affect the post-war period. As they said a year ago, now is the time for us to develop the plans and get everything in readiness so that action will not be delayed too long when labor and materials are both seeking a market. It has often been said that no one factor so influences employment as does building. *(Continued on page 346)*

Agriculture's Big Building Job

By R. W. Carpenter and A. V. Krewatch
FELLOW A.S.A.E. MEMBER A.S.A.E.

THE need for adequate houses and service buildings on American farms is of great importance. To judge this need realistically, one must consider minimum requirements for decent living and the efficiency of the farm for increased food production and storage, as well as keeping farm building values in line with good business.

An analysis of the need for rural housing has been approached mainly by taking inventory of the housing conditions as they exist, and this analysis also indicates that farm construction is big business. Here are some census figures for the value of homes and buildings on the farms of the United States: 1910, $6,325,000,000; 1920, $11,486,000,000; 1930, $12,950,000,000; 1940, $10,405,000,000. These figures indicate a rapid expansion from 1910-20, a period (1920-30) during which new construction and maintenance about kept pace with depreciation, followed by a decade in which farm building values dropped at an alarming rate.

The federal farm housing survey of 1934 indicated that 697,000 farm houses were, in the opinion of their occupants, beyond repair and in need of replacement. It further indicated that new service buildings were needed on 2,170,000 farms. Between 1930 and 1935 (see chart on page 341 of this issue) expenditures for buildings, fences, windmills, and wells were insufficient to prevent a marked physical deterioration of these farm improvements. Since 1936 expenditures have almost offset current depreciation but have been too low to compensate for the deterioration during the preceding period. In 1938 the U. S. Bureau of Agricultural Engineering made the following statement[1]:

"Observations over the past few years made by many individuals of different groups interested in the trend of building conditions on the farm, including farmers themselves, engineers, contractors, and extension workers, have generally agreed that repairs, remodeling, and new construction are not making up for normal depreciation. Few people realize how bad the farm building situation really is. Many structures must be repaired at once or they will soon be worthless. Many have already deteriorated to such an extent that they are beyond repair. On the majority of farms, buildings have not been properly maintained since the postwar drop in farm prices in 1920."

This evidence tells a convincing story of an industry which is allowing its physical plant to deteriorate. Expenditures for new construction and maintenance have lagged far behind depreciation losses. *For the past 20 years the American farmer has been expending his farm building capital in addition to his current income.* This is not a healthy condition.

Nor is this the whole story. No one will argue that at any time in the past have farm homes and buildings reached or even approached acceptable or desirable standards. The 1934 federal survey showed that (1) only 1 farm home in 3 had either running water or a water pump, (2) only 1 farm home in 4 had electricity, (3) only 1 farm home in 10 had an indoor toilet, and (4) only 1 farm home in 10 had central heat.

There is a general association of poor housing and low farm income. While many farm owner-operators are poorly housed, tenants and farm laborers usually have incomes lower than owner-operators and as a rule occupy the poorest houses in their communities. Farm laborers particularly are usually the most poorly housed of all farm people.

Three things must be done to put farm homes and buildings in good condition and keep them so: (1) Normal depreciation must be offset; (2) twenty years' accumulated deficiency in maintenance must be made up, and (3) substandard homes and buildings must be modernized, remodeled, or replaced. To do this will require, at a conservative estimate, the expenditure of one billion dollars annually for many years to come.

In an effort to solve this problem the federal government has expanded credit facilities, reduced interest rates, and under certain conditions has granted direct aid. Some of the agencies functioning in the rural housing field are as follows: Farm Security Administration, Farm Credit Administration, Bureau of Home Economics, Bureau of Agricultural Chemistry and Engineering, Rural Electrification Administration, Federal Housing Administration, U. S. Housing Authority, and the land-grant colleges and universities.

A Suggested Program. It is proposed that the land-grant colleges and universities and the U. S. Department of Agriculture be given the facilities necessary to carry on an intensive program of education, demonstration, and technical assistance in the design, remodeling, and construction of farm homes and buildings. It is true that valuable work of this nature is being carried on at the present time, but it is on a pathetically limited scale. At present less than one-fourth of the states devote the equivalent of one man's full time to extension work with farmers or with county agents on farm building construction problems. It appears that the annual expenditures for specialized agricultural engineering extension work on farm buildings does not exceed $50,000, and that the total amount spent for direct extension and research work in this field by the state agricultural colleges and the U. S. Department of Agriculture (exclusive of FSA and REA) does not exceed $200,000 per year. This is about 3 cents per farm per year.

From studies which have been made it appears that an appropriation starting at $2,000,000 per year and gradually increasing to a maximum of $5,000,000 per year would be needed to carry on an adequate program in this field. Some of this should be used for needed research, a lesser amount for resident instruction to train workers, but the greater part should be used to provide extension workers in the counties working directly with farm families.

Given adequate support, one of the main features of the expanded program should be to provide competent architectural and engineering advice and assistance for the farm family that wants to make building improvements with training in the crafts for boys and men who can do this work. Last year the defense training courses for rural youth provided instructions for the farmer and his family in metal work, electricity, and farm carpentry. Machinery and tractor repair received emphasis last year. This year agricultural engineers as well as the instructors in these defense training courses could well afford to emphasize farm carpentry because such emphasis *(Continued on page 346)*

Paper (abridged) presented September 30, 1941, at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at Jackson's Mill, W. Va. Authors: Head, agricultural engineering department, and extension agricultural engineer, respectively, University of Maryland.

[1]Farm building surveys in Wisconsin, Kansas, Georgia, and Illinois. U. S. Department of Agriculture, Misc. Pub. No. 311, 1938.

Trends in Hay Production

By C. B. Richey
MEMBER A.S.A.E.

THE Committee on Hay Harvesting and Storage of the American Society of Agricultural Engineers has as its objective the evaluation and interpretation of transitions in hay handling and storage. As a first step toward this objective, a picture of hay production in the United States at the present time was desired. To this end, the USDA "Crops and Markets" reports concerning the hay crop were analyzed. This paper will attempt to present the portions of this analysis which are of most significance to agricultural engineers.

In 1941 this auto buck rake handled 200 acres of hay alone, and 600 acres of oats at threshing time along with another buck rake

One interesting fact is that hay yields per acre are down an average of 19 per cent over the United States as a whole for the decade 1929-38 as compared to the decade 1919-28. This decline in yield ranges from 11 per cent in the north Atlantic section to 22 per cent in the far western section. Possible explanations may be the drought years of the early thirties, and/or decreasing soil fertility.

Fig. 1 summarizes the average United States hay production by sections in 1939-40. The percentage of our total hay production in each section is shown, and also the percentage of the various hay crops produced in each section. The north Atlantic section consists of Pennsylvania, New Jersey, and the states northeast. The north central section consists of Ohio, Indiana, Illinois, Missouri, Kansas, and the states north. The south Atlantic section consists of West Virginia, Virginia, Maryland, and the states south along the Atlantic coast. The south central section consists of the remaining states of the south including Texas. The far western section is composed of Montana, Wyoming, Colorado, New Mexico, and the states west.

The hay crop is of greatest relative importance in the north Atlantic states where 56 per cent of the crop land is in hay compared to 20 per cent in the north central states, 7 per cent in the south Atlantic, 13 per cent in the south central, and 21 per cent in the far west.

The most striking facts concerning our hay production are that over one-half of it is produced in the north central states and that the entire South produces only about one-sixth of it. As can be seen from Fig. 1, the term "hay" covers too broad a range to discuss the various crops in detail. There are certain shifts in hay crops taking place, however, and we will take a look at the most pronounced.

In the north Atlantic states there is a gradual but steady shift to alfalfa, although clover and timothy is still the overwhelming favorite.

The most spectacular shift is taking place in the states of Kentucky, Tennessee, Missouri, and Arkansas. Hay acreage is increasing more rapidly here than in any other part of the United States, and lespedeza now accounts for 43 per cent of the total hay acreage compared with an average of 16 per cent during 1929-38. In 1941, 63 per cent of Tennessee's hay acreage was lespedeza. As can be seen from Fig. 2, most of this shift has been at the expense of clover and timothy.

In showing trends, hay acreages have been shown rather than tons produced because the acreages give a better comparison of farmers' intentions from year to year.

Another outstanding shift is taking place in the states of South Dakota, Nebraska, Kansas, and Oklahoma. The use of sweet sorghums such as the sorgos and sudan grass for forage and hay has been increasing by leaps and bounds. Sweet sorghums are not included in the USDA statistics under hay, but they are competitive with hay in these states. In Fig. 3, they are included for purposes of comparison and it appears that they have replaced almost half the alfalfa in this section.

Fig. 4 shows the acreage trends in the seven north central states of Michigan, Wisconsin, Minnesota, Ohio, Indiana, Illinois, and Iowa. These states produce 35 to 40 per cent of the

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Paper presented June 29, 1942, at the 35th annual meeting of the American Society of Agricultural Engineers. A contribution of the Power and Machinery Division and of the Committee on Hay Harvesting and Storage. Author: Assistant professor of agricultural engineering, Ohio State University.

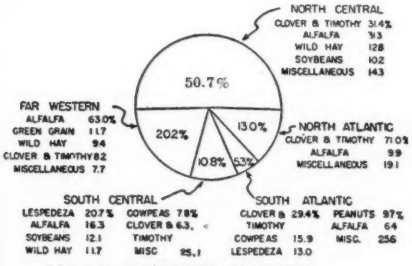


FIG. 1. U. S. HAY PRODUCTION BY SECTIONS 1939-40 AVERAGE 90,140,000 TONS

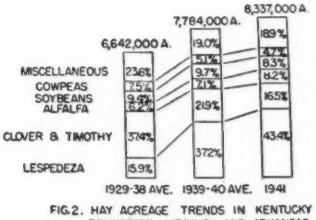


FIG. 2. HAY ACREAGE TRENDS IN KENTUCKY TENNESSEE, MISSOURI, AND ARKANSAS

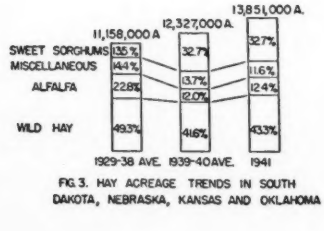


FIG. 3. HAY ACREAGE TRENDS IN SOUTH DAKOTA, NEBRASKA, KANSAS AND OKLAHOMA

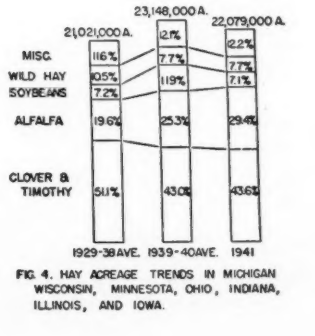


FIG. 4. HAY ACREAGE TRENDS IN MICHIGAN WISCONSIN, MINNESOTA, OHIO, INDIANA, ILLINOIS, AND IOWA.

nation's hay and probably buy more than one-half of the haying machinery manufactured.

Here alfalfa has been steadily gaining at the expense of clover and timothy. Alfalfa yields average slightly higher, and even now the total time spent harvesting alfalfa probably exceeds that for timothy and clover because alfalfa is spread over a greater number of cuttings.

Soybean hay showed an increase for several years, but is apparently losing ground at present. This may be partially due to the difficulty of handling and curing. Most of the wild hay shown is in Minnesota where it accounts for 23 per cent of the total hay acreage.

The A.S.A.E. Committee on Hay Harvesting and Storage is also interested in getting a picture of present hay handling and storage practices. A short questionnaire was recently sent out to each of the major hay producing states, addressed principally to agricultural engineers and agronomists in the state schools who are familiar with haying practices over their states. Table 1 is a compilation of the returns from this questionnaire.

HAY HANDLING METHODS IN SOME OF THE MAJOR HAY PRODUCING STATES (June 1942)

KEY

Collecting	Transporting	Storing	Storage
a, pitch fork	h, wagon or truck	l, hay fork or slings	r, barn
b, hay loader	i, power buck rake	m, stacker	s, stack
c, horse buck rake	j, horse buck rake	n, hand	
d, power buck rake	k, slip	o, stationary chopper	
e, pick-up baler		p, corn elevator	
f, stationary baler		q, combination buck stacker	
g, combination buck stacker			

STATE	APPROXIMATE HAY ACREAGES PER FARM	MAJOR METHODS RANKED AS TO PRESENT IMPORTANCE				
Maine	30	ahlr	bhlr	bhor		
Connecticut	50	ahlr				
New York		bhlr	eh(l,n)r			
Pennsylvania	14-22	bhlr	ahlr			
Ohio	15-20	bhlr	ahlr	dilr	ehnr	
Indiana	15-20	bhlr	ahlr	dilr	ehpr	dior
Illinois	20	bhlr	ahlr	(cf)h(l,p)r	eh(l,p)r	
Michigan	20-30	bhlr	ahlr	dilr	eh(l,n)r	
Wisconsin	22	bhlr	ahlr	bhor		
Minnesota	20-30	bhlr	(bh,c)(n,m)s	gqs	dilr	eh(l,n)r
Iowa	20	bhlr	ehnr	dms	dilr	ahlr
Missouri	30	ahlr	cns	(ah)ns	(cf)hnr	
North Dakota	40-70	c(m,n)s	dms	ahlr	bhlr	(ah)ns
South Dakota	80	cms	bhlr			
Nebraska		dms				
Kansas	30	dms, gqs	bhlr	(ah)ns	(cf)hnr	
Maryland	25	bhlr	ahlr	ahnr		
West Virginia	10-12	ahns	cjnr			
North Carolina	5	ahns	ahnr			
Kentucky	15	ahns	cns	(cf)hnr	bhlr	
Tennessee	12	ah(l,n)r	(ahf)hnr	ahns	bhlr	
Arkansas	10	ahns	ahlr			
Idaho	30	akl(r,s)	c(l,m)s	d(l,m)s	ahl(r,s)	
Montana	60	cms	dms			
Wyoming	50 alfalfa 100 native	cms (c,d)ms	dms			
Colorado	40	(c,d)ms				
Utah	20	ahls	(c,d)ms			
Washington						
Eastern	60	akls	dls			
Western	25	ah(l,n)r	bh(l,n)r			

The operation of hay handling has been divided into the phases of collecting in the field, transporting out of the field, and storing with the type of storage also shown to complete the picture. In the case of hay stacked in the field, the second phase is omitted.

It seems that there are even more variations in methods of handling hay than in kinds of hay. Equipment used in some parts of the country may be entirely foreign to other sections. There are corresponding variations in efficiency in terms of man-hours per ton, probably represented by the *load by hand—wagon—store by hand—barn* combination at one extreme and the *power buck rake—stacker—stack* combination at the other. The *hay loader—wagon—fork or sling—barn* combination still accounts for more hay than any other method although farmers are becoming increasingly dissatisfied with it.

Agriculture's Big Building Job

(Continued from page 344)

and help can arouse a desire for better housing and give farm people confidence in their own skill and ability to get satisfactory buildings at costs within their means. It should include help with plans for remodeling the present buildings or for new structures, provide instruction for the farmer and his family in reading blueprints and in the simpler building operations, and undertake to enlist the cooperation of the country carpenter and builder in developing more modern types of construction. The program should sponsor the holding of building schools and demonstrations in rural communities, foster enthusiasm for good building, develop neighborhood cooperation in the purchase or preparation of material and in use of power tools and equipment, and find ways to apply modern technology to the solution of the farmer's building problems.

This program should recognize the need of better housing for farm laborers and tenants. Toward this end it should promote the practical preparation and use of local, low-cost materials such as homesawed lumber, logs, stone, gravel, and salvaged material. It should provide for training and assistance to utilize the available time and latent skills of the farm laborer or tenant and his sons. The resulting savings in costs of construction should be used to provide the modern home conveniences which mean so much in terms of health and satisfaction.

The state agricultural colleges and the U. S. Department of Agriculture have the nucleus of an organization to carry on a building program of this kind and scope. Such a program cannot be hastily improvised, but must grow slowly as competent leaders are trained. It should be started now, in order that it may be functioning efficiently by the time the after-defense unemployment emergency arrives.

Wartime Prices and Agricultural Engineers

(Continued from page 343)

This is undoubtedly a correct statement, and in agriculture it is the agricultural engineers who can do most about getting building programs planned and under way. Projects in drainage and soil conservation, new developments in farm machinery, and rural electrification should not be overlooked. I hope that those of you who are in educational institutions and those of you who are connected with business institutions, both manufacturing and sales, will take your coats off and see that such programs are planned and made ready for immediate action. This is the kind of thing we must all do. Those of us who remain at home must be big enough to give all-out help to the direct war effort and also to plan the post-war period. Are we equal to this task that must be accomplished if we are to maintain our democracy and our free economic system?

Concrete with Minimum of Steel

By W. G. Kaiser
FELLOW A.S.A.E.

IT IS a well-known fact that steel is a critical material, that practically the entire output of the steel industry is needed in the war production program. There is little steel available for non-war uses. What little there is available must be carefully conserved and used only when absolutely necessary, and then in the most efficient manner. In normal times a large tonnage of steel is used in combination with concrete to produce reinforced concrete, a recognized type of construction in which the structural properties inherent in each material are used most advantageously. The great demand for steel in the war production program therefore makes it imperative that designs of structures employing reinforced concrete be carefully restudied to make certain that every possible ounce of steel is conserved.

While this paper is not a discussion of farm construction as it applies to the present emergency, it is consistent to point out that a certain amount of construction on the farm is necessary to aid and further the war effort.

Farmers have been asked to produce more milk, pork, eggs, and other farm commodities. They have been asked to increase production despite the fact it was known there would be less man power to do the job, due to enlistments and inductions of farm boys and workers into war service, and to the migration of workers from the rural areas to the war industries. Machines and structures will have to multiply the efforts of the workers remaining on the farms.

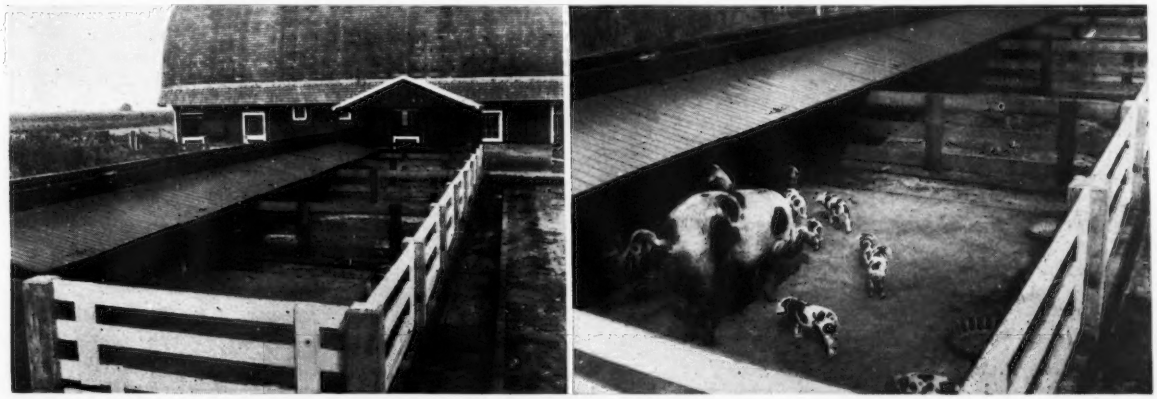
In Secretary of Agriculture Wickard's production goals for 1942 he asked for 7 per cent more milk, 13 per cent more eggs, 10 per cent more chickens, and 14 per cent more pork than were produced in 1941, a record production year. To attain these enlarged production goals it will be necessary for farmers to provide increased housing facilities for dairy cattle, swine, and poultry. With more livestock, more feed grain will have to be stored on the farm and that means more corncribs and granaries. Moreover, there already exists an acute shortage of grain storage facilities in the principal grain-producing areas. Elevators are full to overflowing with previous crops, necessitating the storage of a large proportion of the 1942 crop on the farm. Storage capacity for hundreds of millions of bushels of grain must be built on the farms of this country this year. Essential farm construction must go on. The War Production Board, recognizing the importance of farm buildings in increasing farm production, has issued conservation order L-41, permitting construction costing less than $1,000 per farm per year to be started without authorization.

Besides new construction there is a considerable amount of repair work to be done to make certain that existing structures will serve for the duration. In general, farm structures of this country are in a bad state of repair although considerable progress has been made in the last few years to remedy that situation. Actually farm buildings are worth less today than in 1930 according to the Bureau of Census figures. In the twelve Midwest states which have the largest farm building valuation, there was a decrease in value of $500 per farm in the 10-year period from 1930 to 1940, the reduction being from $2,544 to $2,044 per farm, a 20 per cent decrease. Other regions of the country experienced comparable depreciation in farm building valuation.

So much for that. It is a well-known fact that inadequate and improper housing is responsible for heavy farm losses, potential and actual. In a recent article in *"Poultry Tribune"* it is stated that 60 per cent of the poultry houses in this country are rat-infested. Loss of young chicks on account of rats must be appalling under such housing conditions. Moreover, rats despoil hundreds of millions of dollars worth of grain and feedstuffs. The article goes on to say that the feed eaten and spoiled by three rats would maintain two hens. Every farm structures man knows that a properly constructed poultry house will not permit ingress or shelter for rats.

Unsanitary conditions on hog farms is responsible for heavy hog losses through diseases. An article in a recent issue of *"Wallace's Farmer"* points out that 43 per cent of the pigs born in Iowa died before going to market. In Illinois, another leading pork producing state, the mortality

Paper presented June 29, 1942, at the 35th annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wis. A contribution of the Farm Structures Division. Author: Manager, cement products bureau, Portland Cement Association.



These two views show the confinement system of producing pork recently installed on the farm of Hans Hansen near Cordova, Ill. The equipment consists of a row of farrowing pens seen at the left in each picture, paved yard and feeding floor, a covered shed at one end, and a concrete manure gutter extending along the front. The main posts which hold the gates and partitions are also of concrete construction.

rate prior to marketing was estimated at 40 per cent. In North Dakota it was 70 per cent. Losses in other states are probably on about the same ratio. Secretary Wickard's request for 14 per cent more pigs in 1942 might readily be attained by saving a larger percentage of the pig crop through providing more sanitary housing and surroundings. John Hendriks, master hog farmer of West Liberty, Iowa, has made an outstanding record in saving pigs and keeping his herd of hogs in good health. He practices what is sometimes referred to as the "confinement" method of producing pork. His pigs are confined in a central hog house and on an enclosed concrete paved yard or feeding floor from farrowing to marketing time. He raises two crops of pigs per year. At six months his pigs will average 275 lb in weight. He saves an average of better than 9 pigs per litter. By keeping his pigs on concrete he maintains the high degree of sanitation needed to keep his herd in good health, so essential for rapid and economical gains.

MOST FARM IMPROVEMENTS OF CONCRETE CAN BE BUILT WITHOUT REINFORCING STEEL

Most concrete farm improvements can be built without the use of reinforcing steel. It is not needed in footings and foundation walls under average conditions. It is not required in the construction of farm building floors, feeding floors, paved barnyards, runways, sidewalks, and many other flat surfaces. In the case of floors which are likely to be hauled over with heavy loads (or where the floor is built on a new fill), it is good practice to make the concrete slab 6 in thick. To control cracking, large paved areas should be laid in sections with construction joints extending through the full thickness of the concrete. To make sure that there will be no bond between adjacent sections, a strip of waterproof building paper should be placed against the form face and left in place when the form is removed. Sections 10 ft square should be satisfactory for most paved areas.

Reinforcement was often put in concrete not because it was needed to provide the required additional tensile strength but to obtain a larger factor of safety. Often, too, it was more economical to use more reinforcing steel and thinner sections of concrete than to build thicker sections without such reinforcement. Designs for small watering tanks and troughs, for septic tanks, milk cooling tanks, and similar structures have frequently shown a basket of reinforcing bars or mesh. In most cases steel is not necessary except in limited quantities. In the Portland Cement Association's most recent designs for septic tanks, reinforcing steel is not indicated except in the precast cover slabs. It can safely be eliminated in cover slabs if it is known that heavy loads will not pass over the tanks. At one time we showed considerable steel in our designs for milk cooling tanks. Now we show none.

As I mentioned previously, many areas are confronted with the problem of building granaries. We made some studies to see whether it would be possible to construct concrete grain bins and tanks without the use of reinforcing steel. It was found that circular bins up to 24 ft in diameter and up to 6 ft deep and square bins 10 ft square and 6 ft deep could be built without reinforcement. In both cases the concrete walls are made 6 in thick.

So far in this paper I have discussed farm concrete construction requiring no steel or a minimum amount of steel. What about reinforced concrete? For some structural purposes, reinforced concrete is required to sustain heavy loads, live and dead, and provide the necessary structural stability. Among these are suspended floors in barns, granaries, and other buildings, walls for large grain bins and for silos, flat slab roofs over underground storage cellars, water storage tanks, check dams and flumes, and other structures. While it may not be feasible to eliminate reinforcing steel in such construction, the amount used can often be very substantially reduced by selecting designs which permit most efficient utilization of steel. Let me illustrate. Recently the structural bureau of the Portland Cement Association made some studies on the comparative amounts of steel required in seven different concrete floor systems. The following steel quantities in pounds per square foot of floor are based on 20-ft spans and 100-lb live loads:

1	20-in metal pan	2.77 lb
2	30-in metal pan	2.58 "
3	12-in masonry filler	3.54 "
4	16-in masonry filler	3.43 "
5	One-way slab	3.01 "
6	Two-way slab	3.70 "
7	Flat slab	2.13 "

Note the superiority of the flat slab design from the standpoint of conserving steel. It requires only 2.13 lb of steel per square foot. Incidentally, it not only used considerably less steel than the next lowest type, which requires 2.58 lb per sq ft, but it was found in these studies to be the most economical floor design system. Flat slab here means girderless solid slab with drop panels, column capitals and two-way reinforcement.

REINFORCING STEEL CAN BE SAVED BY REDUCING THE SPAN LENGTH IN STRUCTURES

Obviously steel is saved by reducing span length and the designer should keep this in mind. He should also keep the size of panels as uniform as possible in order save time in construction and to save material. For illustration, a building three bays wide, as in dairy barns, with two rows of stalls with a narrow center bay would require more reinforcing steel than if the three panels were of uniform span lengths.

Allowable Stresses. Raising the allowable stresses in reinforcement is obviously a direct way of saving steel. In recent years there has been a trend to permit higher working stresses for steel in building codes. It would seem that the acute steel shortage would accelerate this trend.

Allowable concrete stresses are in general given in percentage of concrete strength, and increasing the latter may therefore be another approach to saving materials. With present-day cements, a strength of 3,000 psi (pounds per square inch) is easily obtained and designers might well adopt much higher strengths, all the way up to 5,000 psi. Using a higher concrete strength for design purposes will go a long way toward reducing reinforcement in beams for compressive stresses, diagonal tension, and bond. It would also be helpful in reducing dead load, another source of saving critical steel.

Slabs on Fill. For concrete slabs cast on the ground, the customary practice has been to use reinforcement of bars or mesh. The general belief seems to prevail that such reinforcement is needed as a precaution against cracking. There are two important factors to watch in regard to cracking of slabs on fill. The subsoil should have uniform bearing capacity and settlement, and the slab should be laid with adequate contraction joints. If the slab is designed for the loads to which it will be subjected and is properly constructed, reinforcement will not be required and cracking will be confined mainly to the contraction joints where they are harmless.

Walls. In building walls of reinforced concrete, the practice has been to specify *(Continued on page 351)*

Results of a Study of Trends in Methods of Hay Storage

PRESENT hay storage problems date chiefly from the introduction of alfalfa into the humid regions. Prior to that time most hay produced was timothy, red clover, or wild hay which often was left standing until it had partly cured on the stalk before it was harvested. Along with the introduction of alfalfa to the humid areas of this country came extensive developments in the field of nutrition which place great emphasis and importance on quality of alfalfa hay.

Forty years ago nearly all hay was stored long, either in the stack or in the mow. Baling was resorted to principally as a convenience in transporting hay to markets. It should not be inferred that there were no hay storage problems forty years ago, but it must be recognized that they were of a different nature than those which came about with the introduction of alfalfa.

The present confusion in methods of storing hay is not altogether the fault of alfalfa. It is also caused by the great mechanical improvements in farm machinery, need for fire protection, commercial prefabrication of hay storage units, the great reduction in farm labor available for hay making, and a need for better quality hay.

An illustration of the great diversity in hay-making practices often found on single farms, particularly in the larger sizes, is a farm near Sunbury, Ohio, on which part of the first cutting of alfalfa is put into the silo and the remainder cured and chopped into the mow above a dairy feeding barn. When the weather is damp, the hay is put directly into the silo, but if the weather seems fair, the hay is left to cure and is chopped with the same equipment into the barn mow so that these two methods complement each other and help to control quality as affected by the weather. Because with present soil fertility knowledge and developments this farm has a much larger acreage of hay than it can feed on the farm, part of the second and all of the third cutting of hay is usually baled with a pickup baler and sold off the farm. Similar examples could be duplicated in many places in many states. This particular farm has about one hundred acres of hay, but there are many, many farms which have much smaller acreages and at present would find it impractical, if not impossible, to store hay by all three of these methods which require a considerable amount of mechanical equipment and a fairly large labor force; in fact, it appears almost impossible for some smaller farms to apply contemporary mechanized hay-making practices unless the equipment and labor can be furnished in common by a cooperative group of farmers or by a custom operator.

Among the first of the widespread changes in hay storage came chopping which saves considerable space and makes a product that is much easier to handle in feeding. Chopping has proved a valuable addition to hay storage practices; and it is apparent that it has for the present achieved a definite place in the practices on certain farms. Its principal disadvantage has been that it does not reduce weather hazards appreciably and may require more equipment and more labor at hay-making time, although equipment such as the pickup field choppers supplemented by convenient elevating equipment does not involve a large labor force. Chopped hay reduces fire hazard somewhat in that chopped hay tends to smolder; and fire in chopped hay can often be extinguished or removed from a barn before the building is lost. There is no evidence that chopping hay improves the quality of hay over hay made long, although it may heat and develop a cooked flavor that animals learn to like.

Reports gathered by this committee indicate that at present interest in chopped hay is not expanding and that it is not likely to expand very rapidly unless new storage structures can be found that will permit chopped hay to be stored with moisture contents of 30 to 50 per cent. One such step in that direction was reported by Dr. Woodward (AGRICULTURAL ENGINEERING for February 1941). He stated that at Beltsville they had made satisfactory silage with hays containing between 30 and 40 per cent moisture, but went on to say: "What are the advantages of this kind of silage or hay over field-cured hay? All the leaves are saved, the fire hazard is eliminated, it is consumed without waste, and there is no objectionable dust in feeding as is the case with chopped hay. What are the disadvantages? The knives and pipe of the cutter gum

A contribution of the farm structures group of the Committee on Hay Harvesting and Storage, American Society of Agricultural Engineers—G. R. Shier (chairman), S. A. Witzel, I. D. Mayer, J. A. Schaller, and Norton Ives.

Among the first of the widespread changes in hay storage was the adoption of chopping which saves considerable space and makes a product that is much easier to handle in feeding. Chopping has proved a valuable addition to hay storage practices

up the same as they do when field-cured hay is chopped for the mow, only more so; there is so much dust in the silo that men cannot work in it when the cutter is running, and special precautions must be taken to avoid spoilage."

There have also been several attempts to apply forced ventilation to chopped hay, but so far trying to get uniform distribution and velocity of air through the hay mass has not been entirely successful.

AN EXPERIMENT WITH THE MOW CURING OF PARTLY CURED FIELD-CHOPPED HAY

R. C. Miller of Ohio State University reports that on a farm at Maumee, Ohio, partly cured field-chopped hay was stored and dried in a mow of a 36x120-ft barn. In the first attempt to dry this hay with forced natural air ventilation the floor was relaid so that there were about ½-inch cracks between the boards. This was to permit the air to enter the hay from the space between the joists which were used as flues for distributing the air. The lower side of the mow floor joists was sealed with plywood to form flues between the floor joist. The cracks in the mow floor did not prove successful because the rather tough hay seemed to fill the cracks and did not permit the air to enter the hay in sufficient amounts. The final arrangement was to place additional flues on top of the floor similar to that in the long hay drying method. The laterals were spaced much closer than with the long hay, that is, about 3 ft apart. In two years' trials of this method there was varying success. It seems possible to cure the chopped hay with this method; however, there was a tendency to place too much chopped hay in the mow for the amount of air delivered. This is due largely to the fact that chopped hay has a much greater mass for the same volume than does long hay. It is possible that the method will be quite successful if the same volume of air per pound of hay is used with chopped hay as where long hay is used.

Good bright hay was obtained for the most part, but there was some moldy hay at times due to such factors as unequal densities, tramping of hay, varying moisture content, varying depths and unequal distribution of chopped hay which made it difficult to obtain uniform ventilation, cooling, and drying.

The second year of operation a boiler was installed which provided steam heat for raising the temperature of the air. Enough heat was added to raise the temperature about ten degrees. The value of that method is open to question particularly because the extra heat tends to raise the temperature and relative humidity at the upper layer of hay to a point more ideal for molds to develop. The heating equipment has been removed from the installation.

There have been a number of other attempts to provide ventilation for chopped hay, such as in the Wisconsin ventilated cribs and the commercial chopped storages usually similar in shape to silos. S. A. Witzel reported tests (AGRICULTURAL ENGINEERING for June 1936) of various cribs and bins. He concluded that density, length of cut, and moisture content were more important in keeping chopped hay than any particular type of storage or container, although he did recommend that the sides of the chopped hay container should be such as to permit rapid escape of moisture driven to the sides by internal heating in the chopped hay mass.

Tests of round metal hay containers with perforated sidewalls and a central ventilating flue with a rotating ventilator head have not been published but recent reports by D. H. Malcom, H. J. Barre, and C. F. Kelly (AGRICULTURAL ENGINEERING for March 1942) on down draft corn crib flues indicate that similar types of ventilation might have a place in chopped hay storage.

For a number of years temporary structures of slats or fencing, lined with reinforced, waterproofed paper have been used to store silage. Some farmers are using the same type of structure to store chopped hay. After a few days of settling, the cribbing can be removed if it is needed for additional storage structures. I. D. Mayer of Purdue University reports that "This has given satisfactory protection for the hay and has also made it possible to store hay away from expensive structures so as to reduce the fire hazard and also be near the place where feeding is done."

It is not the province of this committee to report on hay silage, but answers to nation-wide inquiries indicated that hay silages were of great interest and that increasing numbers of farmers were making and feeding it. Again the mechanical and storage problems are such that the small farmer who does not need a large volume of forage or who does not have the necessary equipment and storage structure is not apt to make hay silage. Furthermore, nutritionists (I. W. Bartlett in AGRICULTURAL ENGINEERING for May 1939 and T. E. Woodward in AGRICULTURAL ENGINEERING for February 1941) appear to favor feeding hay along with hay silage and see no important nutritional advantage to a ration containing silage as compared to one containing good quality hay for the roughage.

Of more recent origin is the practice of baling hay, not for market but for use on the farm. This has come about largely as a labor and storage space saving device and has been allied to the development of pickup balers. There is at present a decided trend toward increased baling, but pickup baling does not add much to the elimination of weather hazards, and information on storage of hay baled in the field is rather meager.

THERE IS NEED FOR A PICKUP HAY BALER AS SIMPLE TO OPERATE AS A GRAIN BINDER

H. H. Musselman reported in a letter to the committee that the agricultural engineering department at Michigan State College had made a hand baler and used it in 1939 to bale a variety of sizes and shapes of bales of various moisture contents and densities. Some of the bales had openings through the center. Quoting from his letter, "the one conclusion which we reached after examining about a hundred of these bales was that, regardless of moisture or pressure used, any hay which exceeded 25 per cent moisture showed either browning or mold. Our conclusions only confirm those already known that hay must be down to about 25 per cent moisture, or less, to keep safely in the barn."

If a successful pickup baler could be devised that was as simple to operate as present-day grain binders, then hay baling might have such sweeping advantages from the labor standpoint that, regardless of other considerations, it would be widely adopted and in fact become the almost universal hay-making practice. From the storage standpoint this would probably mean a sharp trend toward one-story hay storages where a great weight of baled hay could be directly supported on ground level.

The infant among hay storage methods and practices seems to be the forced ventilation of partly cured hay with unheated air. The experimental and demonstration work for this method has been reported before the A.S.A.E. upon several occasions*. The first installations began in Tennessee and have slowly spread through the eastern and

*T. W. Weaver, Jr. and C. E. Wylie, AGRICULTURAL ENGINEERING, January 1939.

W. E. Hudson, AGRICULTURAL ENGINEERING, May 1941.

J. W. Sjogren and P. D. Rodgers, AGRICULTURAL ENGINEERING, June 1941.

J. A. Schaller, AGRICULTURAL ENGINEERING, August 1941.

southern part of the United States. Forced ventilation permits cutting and mowing hay on the same day if the weather is favorable. It practically eliminates the spontaneous combustion fire hazard in hay; and it is adapted to farms of all sizes and descriptions since the hay is handled long and stored long by conventional contemporary methods. The ventilation equipment is relatively simple requiring a moderate amount of lumber for flues and air ducts. Sources of power frequently exist on farms, such as portable electric motors, gasoline engines, or tractors. The chief item of expense is the fan or blower to force the air.

Since the pressure required to force the air through long hay does not appear to be excessive, if the air distribution system is made ample in size, it is possible to use either aeroplane propeller types of fans or the forward curved blade blowers as well as the less common backward curved blade or straight bladed blowers. In the industrialized regions suitable blowers can often be purchased secondhand at very moderate cost; and even when new blowers are purchased, the cost of a ventilation system is reasonable in comparison with other machinery commonly purchased by farmers. The operating cost will depend upon the amount of moisture in the hay when it is stored, but indications are that it will seldom run more than one dollar per ton. This method of handling hay has some advantages in common with silage and dehydration in that most of the leaves can be saved and the hay does not remain cut long enough to suffer much bleaching or leaching. It may remain cut long enough to receive a certain amount of ultraviolet irradiation which is said to give it more vitamin D than hay made into silage or dehydrated without partial field curing. The barn curing method of hay storage has not been used widely enough as yet to determine its full applications throughout the various climatic regions in the United States, but in the Ohio and Tennessee valleys and in the Southeast where it has been tried, it appears to offer great possibilities for all sizes and types of hay producing farms. There is even some contention that it may supplant hay dehydration, and at least one farmer near London, Ohio, who also operates a grain and feed business, has been producing alfalfa meal from hay cured in the barn with forced ventilation. Whether moderate amounts of heat could satisfactorily be added to the forced ventilation system is open to question; and there is also need for investigation as to its possibilities in conditioning chopped and baled hay.

THE BUCK OR SWEEP RAKE WILL DOUBTLESS INFLUENCE THE TREND OF HAY STORAGE

Another mechanical device which may affect hay storage is the auto or tractor buck rake. With this equipment it is possible to handle long hay very rapidly with little labor. The buck rake is adapted to small as well as to large farms. Probably the least labor in hay storage is involved when hay is picked up in the field with the buck rake, hauled to the barn, dropped on a sling, and hoisted into a conventional type mow using either the buck rake or an electric hay hoist for hoisting power (C. B. Richey and R. D. Barden in AGRICULTURAL ENGINEERING for June 1942). If the power buck rakes should continue to gain in use, the trend would be toward storing hay long, and of the various hay-making methods the forced ventilation of long hay is well adapted to complement the buck rake. Such a hay-making program can be operated by one man if necessary.

At present there is great need for additional information on the labor involved in making and feeding hay by various methods, the effect of storage methods on quality, the relationships between nutrition and the quality and amounts of various types of forage needed and accurate estimates and designs for various structures and structure combinations to provide best the facilities needed.

Not much has been said about the actual design of barns and hay storages thus far, and with the present confusion in hay handling practices perhaps it is somewhat premature to be very definite about the hay storage structure of the future, but there are several important factors that need incorporation in any design.

The hay storage must maintain the quality of whatever hay is stored; it must be convenient to use in connection with mechanical equipment, labor, and livestock; fire hazards should be at a minimum; it should be of such construction that it is adapted to a long range operating program involving a certain amount of evolution in farm practices; and lastly it should of course be adapted to the kind of construction materials which the farmer can use or finance.

In general, present hay storage simmers down to the outside stack, the one floor wing or detached shed, the special bins and silos for chopped hay, and the conventional overhead types of storage used above livestock.

For the present it is out of the question to expect many farmers to shift rapidly to new storage structures, but we can expect considerable remodeling of present facilities and when materials and labor are again plentiful, considerable new building.

SHALL THE INITIAL COST OF FARM BUILDINGS BE ON THE BASIS OF MINIMUM COSTS?

There is a school of thought (D. Howard Doane in AGRICULTURAL ENGINEERING for September 1941) which holds that the initial cost of farm buildings should be at a minimum and that the buildings do not need to be especially durable, arguing that agriculture is changing so rapidly that it is impossible to plan ahead far enough to justify long-lived buildings. There is some merit to the argument because it may permit farm operations and practices that could not have otherwise been financed. On the other hand, we had a situation ten years ago where the farms which had good durable convenient buildings were able to continue operating because for a time they could postpone the necessity for maintenance expenses, while those on which the buildings were depleted or were nonexistent were at a critical disadvantage in utility and value. Today agriculture again is facing a critical building situation. We are challenged with the task of providing good quality roughage with the minimum of labor and materials. Too few farmers have the conveniently arranged, durable, long-life buildings that are a national asset in these difficult months. Doubtless there will be much successful improvisation as well as numerous failures. The tendency will in many cases necessarily be toward inexpensive labor-saving methods and toward the use of non-critical materials. The A.S.A.E. can do much by publishing ideas and information that are solving situations.

Concrete with Mininum of Steel

(Continued from page 348)

about 0.25 per cent of reinforcement horizontally and 0.15 per cent vertically, with additional reinforcement around openings. It appears now that reinforcement may be reduced in walls provided with sufficient control joints. A control joint is a section through a wall which is designed to crack, thereby relieving stress in a wall due to volume change. It can be built so the crack in the joint is concealed. If control joints are placed in proper location, the typical wall reinforcement probably can be reduced one-half without impairment of the structure.

Problem of Estimating Farm Machine Needs

By Oscar W. Meier
ASSOCIATE A.S.A.E.

FIRST OF all I shall outline briefly the functions and responsibilities of certain agencies of the War Production Board whose decisions and activities affect the subject under consideration.

Charged directly with administering the wartime production program of the farm machinery industry is the Farm Machinery and Equipment Branch under the Office of the Director General for Operations. This branch is responsible for getting maximum conversion of the industry to war work consistent with the provision of minimum essential civilian production of farm machinery.

On June 4, WPB Chairman Donald M. Nelson issued a directive establishing the Food Requirements Committee, which is charged with responsibility for determining direct and indirect military, other governmental, civilian, and foreign requirements for foods, and for recommendations to the Requirements Committee of the War Production Board as to requirements for supplies or equipment needed for the production of food.

The third agency with which we are immediately concerned is the Office of Civilian Supply, which is directed to bring together and analyze data on *all* civilian requirements and to make recommendations for the allocation of scarce materials among competing civilian needs. Recently this responsibility has been interpreted to include all domestic requirements except those classified as direct military.

And finally, the key group on whose decisions all programs which require scarce materials depend is the Requirements Committee. This committee determines what amount of scarce materials shall be allocated for military use, what amount for lend-lease requirements, what amount for other export, and what amount for domestic civilian use.

As early as last spring the Iron and Steel Section of the Office of Civilian Supply advised that the outlook for civilian steel supplies in late 1942 and through 1943 was for not more than 50 per cent of the amount available in 1940. The Agricultural Machinery Unit was asked whether or not a curtailment of 50 per cent or greater could be applied to farm machinery manufacture in 1943 without jeopardizing food production so seriously that a food shortage endangering victory more than a shortage of armaments would result.

We assumed, of course, that the primary objective of every American citizen is to win the war, no matter what the consequences to him as an individual. Many must give their lives. Others may lose their fortunes. Many of us may have to go on restricted rations. But win we must, no matter what the consequences.

To win the war we need iron and steel; we need skilled industrial labor. We do not now have enough of either. Any use of critical materials or skilled labor for the production of civilian goods means just that much less for military and naval production. Any use of critical materials or skilled labor for the production of civilian goods *which are not absolutely essential* means waste of those materials and of that labor. It means more than that. It means investment in defeat, and that at a time when every ton of steel and every hour of labor is necessary to turn the tide of the war in favor of the United Nations.

At the same time, we must produce food. We need food now for the people of the United Nations. We need stockpiles of food to nourish the starving peoples of the Axis-conquered countries after we win the war. To produce food we need agricultural machinery.

To save steel and industrial labor and to produce food, that is our task. To save as much steel and industrial labor as is possible, but at the same time to attain the agricultural production requirements, that is the challenge. To determine how little agricultural machinery we can get along with and still produce the food we need, that is our problem.

In June of this year the Office of Civilian Supply recommended a program for the production of farm machinery and repair parts based on a careful study of the situation as it then existed. During the summer the Food Requirements Committee also made recommendations to the Requirements Committee calling for a somewhat higher level of farm equipment production than that recommended by the Office of Civilian Supply. The developments since this summer have all been such as to force 1943 farm machinery production to a level even lower than that originally recommended by the Office of Civilian Supply. The agricultural crop year has drawn nearer to the close with probable record harvests. In attaining peak production, farmers in general did not lack equipment. Farm machinery sales in 1942, combining production allowed under L-26 and inventories carried over from the previous year, were among the highest on record. Repairs were adequate with few exceptions, and there is good reason to believe that existing machinery is in unusually fine repair. The farm labor situation did not develop to be as serious as some predicted. True, some shortages did occur but these were primarily in the hand harvesting of crops, and hence were not of the type which can be alleviated by additional new machinery. Furthermore, the possibilities of obtaining more effective use of farm machinery through cooperative and custom use have remained virtually untapped.

These several factors, taken collectively, have brightened the agricultural picture. On the other hand, foreign food requirements of our allies may increase, although shipping difficulties may make it impossible to satisfy these new demands. Whatever the facts in the latter respect, the record harvests this year are likely to be considered in the nature of windfalls in the sense that they will not be allowed to unduly influence 1943 production goals. This is justified, of course, because the vagaries of nature may result in 1943 harvests being as stinted as 1942 harvests were abundant.

Thus while a level of farm machinery production lower than that recommended by the Office of Civilian Supply in June might imperil the attainment of 1943 production goals—and it is well that this possibility be recognized—failure to attain 1943 production goals can now be viewed as less serious than would have been the case had 1942 harvests been less plentiful. *(Continued on page 355)*

Paper presented September 28, 1942, at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers at New York City. Author: Chief, farm machinery and equipment unit, Office of Civilian Supply, War Production Board.

Soil Erosion Control Practices that Meet Wartime Needs

By Ralph C. Hay
MEMBER A.S.A.E.

TO MEET wartime demands, workers in soil conservation have been required to reorient their thinking and planning. Agriculture's number one task is to produce in greater quantity than at any time in history. Any practice to save soil that may impede wartime agricultural production or even fail to aid production cannot be justified now. Why save the soil if in so doing we endanger our nation and freedom? Hence only soil conservation practices that will aid in production *now*, in 1942, deserve special effort. Farm people must be encouraged (1) to get maximum production from their farms with the best use of labor and machinery and (2) to avoid waste of soil resources. If longtime goals can be kept in sight and these immediate objectives accomplished, the future will be easier. If the practices and recommendations made now are sound and acceptable over a longtime period, farm people will continue their use and will serve as leaders in spreading their adoption in the postwar period.

Terraces have been recommended and demonstrated by the University of Illinois for 20 years. Resurveys made on fifty of these demonstration fields in 1937 and 1939 by the University's department of agricultural engineering indicated that those properly maintained were giving satisfactory results. The failures and unfavorable attitudes toward the use of terracing have developed from two difficulties —a lack of maintenance and little or no planning of terrace systems and outlets. Since the success of terracing depends on proper maintenance or more properly on contour cultivation, particular emphasis has been given this practice. In the past five years 1800 leaders have been trained to farm on the contour. Other extension workers and farm advisers have also taught contouring as a part of the coordinated extension program in soil conservation.

Paper presented June 29, 1942, at the 35th annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wis. A contribution of the Soil and Water Conservation Division. Author: Assistant professor of agricultural engineering extension, University of Illinois.

To supplement contour farming and at the same time prepare for future terrace outlets, the use of sodded drainageways, or grass waterways, has also been widely recommended. These two simple practices, contouring and grass waterways, readily lead to terracing or strip cropping when the need for more complete control is evident and farmers are ready to take the next step. These practices have been recommended as the first steps toward more permanent mechanical erosion control in farm plans.

Several thousand Illinois farmers have come to use contour farming as a regular practice. A three years' study of farm account records on 246 such farms in four Illinois counties has been carried on cooperatively by the USDA Soil Conservation Service and Bureau of Agricultural Economics and the department of agricultural economics of the University of Illinois. The records indicate clearly that for maximum production, as well as for conservation of the soil and increased income, sloping crop land should be farmed on the contour. Results from these same studies show definite increases in yield on land farmed on the contour.

AVERAGE CORN YIELDS ON THE CONTOUR AND NOT ON THE CONTOUR ON THE SAME FARMS IN 1941[1]*

	St. Clair and Madison	McLean	Stephenson
Number of farms	19	19	21
On the contour	64.0 bu	66.0 bu	81.7 bu
Not on contour	53.3 bu	63.8 bu	69.8 bu

The above results came from farms on which both contour planting and the conventional straight-row planting were used so that a comparison of the practices by the same farmers could be made. This information shows clearly that contour farming increases yields. Comparisons were made in this same study of 35 farms on which all or a con-

*Superscript numbers refer to the references appended to this article.

The soil erosion control practices recommended by Mr. Hay in this paper have a direct bearing on increasing farm production to meet wartime demands, on reducing farm labor requirements, and on the more economical and efficient use of farm equipment. On most farms sound soil and water conservation and erosion control practices will make it possible for the farmer to contribute more to the war effort, since they fit definitely into such a program. The picture shows the tandem-drive motor grader referred to by Mr. Hay, at the time the 1940 tests on terrace construction were being made

siderable part of the farming operations were on the contour and 35 comparable neighboring farms on which none of the field operations were on the contour. Power and labor costs per crop acre, as well as total farm operating expenses, have been practically the same on these two groups of farms for the past two years. Thus contour farming in addition to aiding in controlling erosion and increasing crop yields can be performed at no increase in farm operating costs. Furthermore, those farmers using contour practices are growing more livestock, seed crops, and producing more milk, meat, and wool. This information provides a sound basis for continued emphasis on the practice of contour farming. It actually aids in increasing production without increasing power and labor requirements.

There is little doubt that under most conditions terracing greatly increases the effectiveness and permanence of contour farming. Contour farming has increased sufficiently in some areas of the state so that the need for terracing has also been recognized. There is no need for the terrace construction program in these areas to be seriously hampered by the present wartime emergency. This statement is true because of the development or adaptation of old methods of terrace construction to present conditions. Most of the new terraces in Illinois this year will be constructed with farm tractors and moldboard plows.

THE NEW TECHNIQUE IN TERRACE CONSTRUCTION WITH A PLOW IS NOW ACCEPTED

A new technique, developed by Paul M. Pittinger, conservationist in the Montgomery County soil conservation district at Hillsboro, and M. T. Ekovich, Soil Conservation Service area engineer at Edwardsville[2], for terrace construction with a plow is now favorably accepted throughout the state. This method of construction is started by plowing, as to backfurrow a land, but leaving a width of 10 to 12 ft uncovered between the furrows. Then successive plowing out three to five rounds five to seven times works a wave of soil across the originally uncovered width or "island" until the soil has been thrown together to form the ridge. In each plowing, the front plow bottom is moving solid earth so that under most conditions plows can be kept scouring satisfactorily and the earth moving well. By plowing off the same number of rounds each time and working down hill from the stake line, the terrace channel made up essentially of a series of open furrows is developed. On slopes of greater than 6 per cent, this method can be adapted to move practically all the earth from the upper side and to plow the land between terrace intervals on the return trip.

The advantages of the plow method of terrace construction are as follows:

1 Regular farm equipment available on nearly every farm can be used
2 Only one operator is required
3 Farmers quickly learn the use of this method
4 Farmers can readily rebuild and maintain terraces by this method
5 Part of the field can be contour plowed while terraces are being constructed
6 Terraces so constructed are generally well shaped to work with farm machinery.

The disadvantages of the method are:

1 Terraces constructed have lower ridge heights than usually recommended, that is, not over 15 in before settling
2 Steep slopes, over 8 to 10 per cent, cannot be terraced satisfactorily
3 Construction is slower than by some terracers.

Farmers who have previously had experience with terrace construction with other equipment seem quite generally "sold" on this new plow method. The report of a young farmer in Putnam County, who constructed terraces with a tractor and blade in 1936, built terraces in the community with a whirlwind terracer, and more recently constructed terraces on his father's farm with a plow, is that he considers the latter method "tops." This reaction is typical of other farmers who have tried the method.

Another method of terrace construction that utilizes equipment available in many communities and which particularly appeals to contractors and engineers, is the use of the tandem-drive motor grader. Tests were made in 1940 on terrace construction with tandem-drive motor graders in which the Soil Conservation Service, the University of Illinois department of agricultural engineering, and a grader manufacturer cooperated. Using both the 10 and 12-ft blade machines, with 35 and 46 hp diesel motors, respectively, terraces with a ridge width of 20 to 25 ft and ridge height of from 18 to 22 in, were constructed at a rate varying from 200 to 350 ft per hr. This equipment when available and not used full time for road construction and maintenance can be used for rapid terrace construction. Most operators are experienced and readily learn terrace construction. Usually drainage type terraces, built from the upper side only[3], as described in Illinois Circular 513, are constructed with grader equipment. The motor grader appears to be a little unwieldy on small fields; however, it is not at as great a disadvantage under such conditions as a tractor and grader with the same blade size. Motor graders have also been quite extensively and successfully used for blading in gullies in the preparation of terrace outlets and grass waterways.

THE FORMLESS CONCRETE FLUME IS A NEW DEVELOPMENT WITH GOOD POSSIBILITIES

Although reinforced concrete dams have been quite commonly used throughout Illinois, not only for gully control and terrace outlet protection but also as outlet structures for tile lines in drainage ditches, their cost has generally been excessive. In using this type of structure, the Soil Conservation Service in Illinois has established a high standard of construction and has obtained a high percentage of success. In the past two years, because of the diminishing supply of CCC labor and the organization of numerous soil conservation districts in which only technical help is available, the use of such structures has been limited. In many cases it is true that gully control structures can be delayed in their construction until after other practices giving immediate returns can be applied. Under some conditions, however, fields cannot be safely terraced; or gullies cutting fields into two or three parts and creating hazards to farm machinery cannot be controlled until permanent structures are built. The rather wide use of sod flumes and sod hump dams has helped solve this problem in small watersheds. However, when the flow and velocity are too great for sod, other more or less low-cost methods have been tried. The most satisfactory probably have been creosoted plank notch spillway dams with concrete aprons, and earth dams with inclined tile or tube outlets. These types of construction have been only partially satisfactory.

Through the cooperation of C. A. Kincaid, Illinois farm field representative of the Portland Cement Association, two installations of the formless concrete flume, developed by the University of Missouri[4], were made in Illinois in 1941. Observations after the first year are sufficiently encouraging to permit the recommendation of their trial in all sections of the state. Records kept on three such structures indicate that these flumes cost approximately one-

fourth as much as reinforced concrete notch spillway dams. Labor requirements are about in the same proportion, since forming and skillful bending and placing reinforcing steel are not required. At the recommendation of engineers from the Portland Cement Association, the most recent construction job in Illinois was completed without the use of any steel.

The essential features that make this structure satisfactory for gully control under both normal and wartime conditions include:

1 Low materials cost, one-third to one-fourth that of the regular notch spillway dam
2 Low labor requirement
3 Permanency
4 Simplicity of construction
5 Satisfactory construction requires the use of high strength concrete
6 Its design as a sloping flume requires no support of a vertical wall of earth
7 It may be built without reinforcing steel.

The practices mentioned above are recommended since they have a direct contribution to make to increased production, reduced labor requirements, or more economical and efficient use of farm equipment. If they cannot meet these requirements, their use can be halted for the duration. On most farms sound soil and water conservation and erosion control practices will make it possible for farmers to contribute more to the war effort, since they fit definitely into such a program.

REFERENCES

[1]Summary of Farm Account Record Study of Farms in Madison and St. Clair, McLean, and Stephenson Counties, Illinois, 1941. Department of Agricultural Economics, University of Illinois. Three mimeographed leaflets, AE1824, AE1851, and AE1853.

[2]Plow Method of Terrace Construction, Paul M. Pittenger. Regional Bulletin SCS689 CCC644, U.S.D.A. Soil Conservation Service, Milwaukee, Wisconsin.

[3]Save the Soil with Contour Farming and Terracing, University of Illinois, Agricultural Extension Circular 513, E. W. Lehmann and R. C. Hay, 1941.

[4]The Missouri Soil-Saving Dam, University of Missouri, Agricultural Experiment Station Bulletin 434, J. C. Wooley, W. M. Clark, and R. P. Beasley.

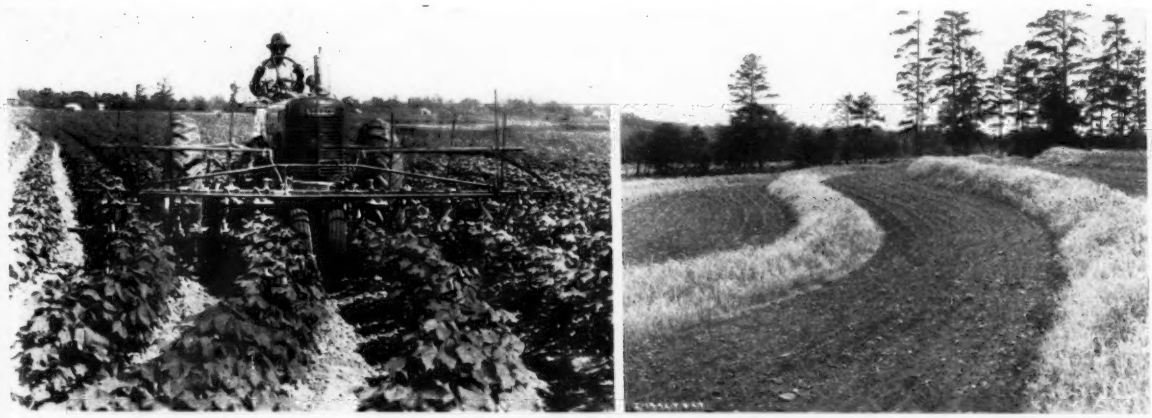
Problem of Estimating Farm Machine Needs

(Continued from page 352)

Along with the improvement in the agricultural situation, the iron, steel, and other metals situation has become more critical. With war production already affected by material shortages, prospects that the situation will improve measurably during the coming year are not good. In the light of these facts, the Office of Civilian Supply has drawn up a revised estimate of agricultural machinery requirements which is designed to show where additional cuts can be made with the least possible impact on attainment of 1943 agricultural production goals. The cut is not really drastic. Compared to 1940 the total program would be 42 per cent instead of the 48 per cent originally recommended. This revised program will require 509,000 tons of steel as against the 586,000 tons called for in our original recommendation and 689,000 tons at the Food Requirements Committee level. As compared with scheduled farm equipment production in the 1942 manufacturing year, the revised program will release 540,000 tons of steel for much needed war goods.

The Office of Civilian Supply also requested that farm machinery be rationed and a suggested program was transmitted to the Office of Price Administration and the Department of Agriculture. The Department has recently initiated an interim rationing plan pending the establishment of a permanent plan. We feel that this rationing program is of great importance. In the first place, it will insure that the available equipment goes to those farmers who can make the most effective use of it. In the second place, if it is applied carefully, it will provide the best possible estimate of farm equipment needs in coming seasons.

In conclusion, it may be well to point out that depending upon the course of the war the materials situation may improve or worsen. It is not impossible that production of more civilian commodities using steel will be cut out altogether, and that the program for farm equipment may be set at even lower levels than the lowest yet recommended. For these reasons, it is imperative that effective programs be initiated to insure the maintenance and maximum use of the equipment which we now have. Agricultural engineers will lead the way in this program. It must not fail.



To meet wartime demands, soil conservation specialists have had to reorient their thinking and planning. Farm people must be encouraged (1) to get maximum production from their farms with the best use of labor and machinery and (2) to avoid waste of soil resources. If these immediate objectives can be accomplished, while keeping in sight the longtime goals, the future will be easier. If the practices and recommendations made now are sound and acceptable over a longtime period, farm people will continue their use and will serve as leaders in spreading their adoption in the postwar period. Agricultural engineers have a definite responsibility in this direction

A Tractor Level for Laying Out Contour Lines

By O. J. Trenary and W. S. Piercey
MEMBER A.S.A.E.

AN INSTRUMENT for laying out contour lines with a tractor has been designed and developed by the agricultural engineering department of the State College of Washington. It is called a tractor level, and is mounted rigidly on the tractor in front of the operator. It indicates the grade the tractor is operating on or off the contour.

The level is made up of a 5-ft piece of 2-in pipe, on each end of which is an elbow and a 10-in standpipe. The top end of the standpipes are connected together by means of a piece of 3/8-in pipe, which seals the water channel from dust and dirt. The mechanism is mounted on top of the tractor so that it is parallel to the direction of travel of the tractor at all times.

The instrument is filled with water so that it rises in the standpipes to one-half their height when the tractor is level. One standpipe is designed like the water gage of a boiler so that the water level can be noted. As one end of the level is raised above the other, there is a vertical movement of water in the glass tube, and it is calibrated in degrees so that the operator may easily note the exact grade at which the tractor is operating.

Shocks and vibrations transmitted from the tractor would normally cause a great deal of movement of the column of water in the water glass, and would make it difficult for the operator to read. This is overcome by incorporating two valves, one on either side of the standpipe containing the glass tube. By closing these valves, the rapid movement of the water column due to shock and vibration may be dampened down until there is a gradual movement of the water column. The amount of dampening may be adjusted to suit the operating conditions.

The tractor level is constructed largely from common hardware items. The bottom section consists of a 2-in piece of pipe, with a common shutoff valve near the water-glass end. The air line across the top is a piece of 3/8-in pipe with a common shutoff valve near the water-glass end.

The accompanying detail sectional drawing shows how the glass tube is fastened inside the 3/4-in pipe so there will be no leaks at the top or bottom. Common graphite asbestos water pump packing is used and provides a good seal.

There is a 3/8-in slot running to within an inch of each end of the 3/4-in pipe. This makes it possible for the operator to observe the movement of the liquid in the standpipe. The level is calibrated with the level mark etched in the center on the 3/4-in pipe. It is not necessary to calibrate above and below the level mark, as the operator is usually interested only in the level position for laying out contours.

The tractor is run on a level piece of ground, and the level is attached and adjusted so that the water level reads on the level mark. Then it is ready for use in the field. The operator keeps the water in the water glass on the level mark, which results in the tractor's traveling on a contour.

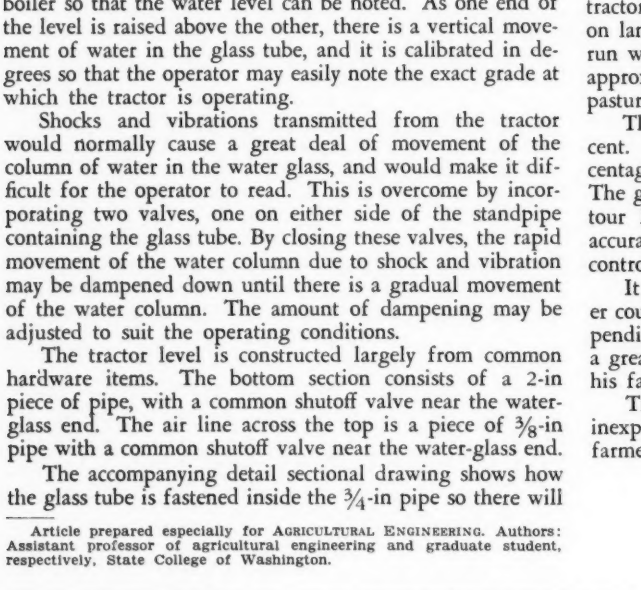
In tests shown by accompanying graphs, the tractor level was rigidly mounted on an International TD6 track type tractor, which was operated on several different slopes and on land planted to different crops. All contour lines were run with the tractor operating in third gear at a speed of approximately 3.0 mph. Contour lines were run on grass pasture, alfalfa, meadow, and wheat stubble.

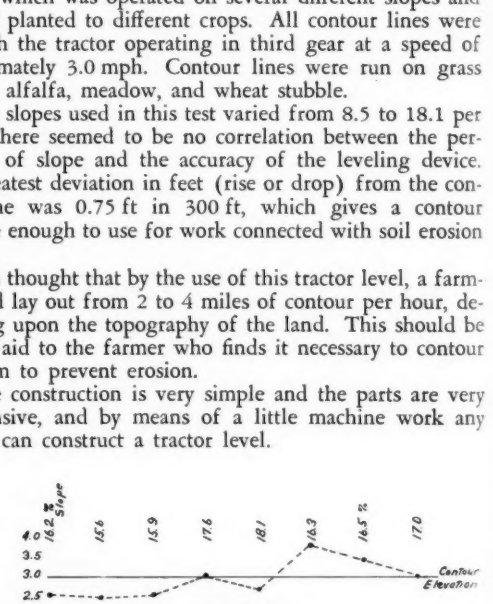
The slopes used in this test varied from 8.5 to 18.1 per cent. There seemed to be no correlation between the percentage of slope and the accuracy of the leveling device. The greatest deviation in feet (rise or drop) from the contour line was 0.75 ft in 300 ft, which gives a contour accurate enough to use for work connected with soil erosion control.

It is thought that by the use of this tractor level, a farmer could lay out from 2 to 4 miles of contour per hour, depending upon the topography of the land. This should be a great aid to the farmer who finds it necessary to contour his farm to prevent erosion.

The construction is very simple and the parts are very inexpensive, and by means of a little machine work any farmer can construct a tractor level.

Article prepared especially for AGRICULTURAL ENGINEERING. Authors: Assistant professor of agricultural engineering and graduate student, respectively, State College of Washington.





Contour Lines as Run by Tractor Level versus True Contour

Duty of Field Machines

By E. G. McKibben, E. O. Heady, and J. A. Hopkins
FELLOW A.S.A.E.

THE DATA presented in this paper was obtained through a project of the Iowa Agricultural Experiment Station initiated early in 1941 to obtain up-to-date and accurate information on the vital problem of the distribution and use of field machines on Iowa farms. Approximately 3,000—about 1.5 per cent, or one out of each 66—Iowa farms were included in the study. These farms were selected on a random basis planned by the statisticians of the Iowa station.

In size, these farms varied from less than 40 to over 360 acres, with the average 180 acres, or about 20 acres larger than the state average for the 1940 census. The distribution according to size is shown in Table 1. As one check on the reliability of the data obtained, the acreage of corn for the state was calculated on the basis of the reported use of corn planters, and this acreage compared with that reported by the Crop and Livestock Reporting Service. The difference between the two figures was less than 2 per cent.

TABLE 1. SIZE DISTRIBUTION OF FARMS FROM WHICH DATA OF TABLES WERE OBTAINED

	Number of Farms	
Farm size, acres	Sample A	Sample B
0 — 40	93	84
41 — 120	871	863
121 — 200	1132	1227
201 — 280	454	453
281 — 360	227	240
361 and over	134	145
Total	2911	3012
Average size in acres	179	181

NOTE: Data for all machines except corn pickers and combines were obtained from Sample A, which includes farms from 92 of Iowa's 99 counties. Sample B, from which the data for corn pickers and combines were obtained, included farms from 96 counties.

The annual use of twelve kinds (72 types and sizes) of machines is shown in Table 2 (next page). In some cases, such as 19 – 36-in tractor plows, two-row horse-drawn corn planters, and two-row cultivators, there is no question but that the samples are large enough to give reliable information. In other instances, the samples are too small to offer more than an indication of the probable duty.

For all machines, the average duty was very low compared with either the theoretical performance which might be calculated on the basis of width, usual speed, and a reasonable operating season or the actual duty reported for the larger farms. The accomplishment on the smaller farms was of course still less. On farms of 120 acres or less the average accomplishment per machine was only 71 per cent of the average for all farms. On the other hand, the accomplishment on the farms of over 280 acres averaged 147 per cent of the average for all farms. Still more striking were the maximum annual accomplishments reported for the various machines. These averaged 452 per cent of the average duty of the same size of machines.

A more complete picture of the relation of the size of farm to the annual use of fourteen important corn belt machines is given in Table 3 (page 359). The data in this table indicates a rather close correlation between these factors, except in the case of the corn picker and the combine. For these machines the size of farm appears to have little effect upon the annual use. This situation is, in part at least, explained by the fact that these are relatively expensive machines which have only recently attained acceptance and which are suited to custom operation. It will be interesting to note whether or not after the war these implements attain a pattern of annual use similar to that of the older types of machines.

In order to obtain a better idea of the practicable upper limit of annual use the lowest and average use for the highest ten per cent of four common machines is tabulated in Table 4. For these machines the lowest annual use of the highest ten per cent was approximately twice the average for all farms, the average for the highest ten per cent was over two and one-half times the average for all farms, and the highest annual use was nearly five times the average for all farms.

These data suggest the following questions: (1) Why is the average annual use so low? (2) What is the practicable annual duty of field machines compared to their average annual use? (3) What can be done to increase the annual use?

TABLE 4. PERCENTAGE DISTRIBUTION ACCORDING TO ANNUAL USE OF FOUR COMMON FIELD MACHINES

	Two-bottom tractor plow, per bottom	Two-row corn planters, per row		Corn pickers, per row		Five and six-foot combines, per foot
		Horse-drawn	Tractor-drawn	Single-row	Two-row	
Avg. annual use, acres	35.4	26.4	42.8	68.2	81.4	33.4
Lowest annual use of highest ten per cent, acres	75	50	88	132	155	70
Avg. annual use of highest ten per cent, acres	89.9	65.9	109.9	183.5	225.6	94.8
Highest annual use, acres	250	158	140	328	355	157
PERCENTAGE OF MACHINES WITHIN GIVEN RANGE OF ANNUAL USE						
0- 25 acres	33.1	56.1	29.2	9.6	8.7	49.3
26- 50 acres	49.3	34.9	38.5	34.9	20.1	28.4
51- 75 acres	11.5	7.2	17.7	22.9	25.2	15.5
76-100 acres	4.2	1.3	8.3	16.9	15.1	3.4
101-125 acres	0.9	0.3	4.2	4.8	10.1	2.7
126-150 acres	0.8	0.1	2.1	6.1	9.7	0.7
151-175 acres	0.1	0.1	0.0	2.4	4.7	0.0
176-200 acres	0.0	0.0	0.0	2.4	1.7	0.0
Over 200 acres	0.1	0.0	0.0	0.0	4.7	0.0

Important reasons for the low average annual use are (1) small farms and the desire of the operators of these farms to be independent, (2) the probability of adverse weather conditions, (3) higher yield and better market premiums for timeliness, (4) ineffective management, and (5) unfavorable topography. The first of these is of considerable social importance. It is closely related to that for which we as a nation are fighting. As to adverse weather, only one or two bad seasons are required to justify an investment in what to the casual observer would appear to be excess machine capacity. Although the premium in timeliness is difficult to evaluate, it is nevertheless very real. It is a phase of field machine management to which agricultural engineers and agronomists might well give more attention. *(Text continued on page 366)*

Paper presented June 29, 1942, at the 35th annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wis. A contribution of the Power and Machinery Division. Journal Paper No. J-1062 of the Iowa Agricultural Experiment Station. Project No. 529 in cooperation with the Agricultural Marketing Service and the Works Progress Administration. Authors: Respectively, professor of agricultural engineering (now of Michigan State College), instructor of economics and sociology, and associate professor of economics and sociology, Iowa State College.

TABLE 2. USE OF FIELD MACHINES ON FARMS IN IOWA IN 1941
(DATA OBTAINED FROM SAMPLES IN TABLE 1)

Machine Kind	Machine Size	No. of machines in sample	Avg. total annual use, acres* 0–120-acre farms	All farms	281 acres & over	Max. annual use acres*	Avg. annual use on other farms, %	Machines used on other farms**, %	No. of other farms per machine†	Terms of use on other farms Partnership, %	Exchange, %	Custom††, %	Loan, %
Plows, horse-drawn	18-in & under	823	18.6	20.6	32.7	170	1.5	3.7	1.0	0.6	0.0	0.3	27.3
	19-in & over	211	26.3	34.5	55.1	93	0.6	1.5	1.0	0.0	0.0	1.5	0.0
Plows, tractor-drawn	18-in & under	233	32.6	57.1	101.5	210	2.1	7.2	1.0	0.5	0.0	4.1	2.6
	19 – 36-in	1,405	46.5	70.8	116.8	500	5.2	8.6	1.0	1.6	0.0	3.2	3.9
	Over 36-in	154	47.5	98.3	128.4	250	10.7	18.6	1.0	4.2	0.0	11.8	2.5
Disk harrow, single, horse-drawn	8-ft & under	454	63.5	77.9	87.9	350	1.2	3.2	1.0	0.0	0.0	0.3	2.9
	9 – 10-ft	470	96.3	129.2	242.9	400	1.4	2.2	1.4	1.1	0.0	0.0	1.1
	11 – 15-ft	52	122.3	140.4	269.0	550	3.1	6.7	1.0	4.5	0.0	0.0	2.2
	16-ft & over	21	111.4	116.3	166.0	399	5.8	15.4	1.0	7.7	0.0	0.0	7.7
Disk harrow, single, tractor-drawn	8-ft & under	71	91.9	146.4	325.2	480	3.5	7.0	1.0	1.8	0.0	3.5	1.7
	9 – 10-ft	451	146.3	182.6	210.8	900	3.9	6.6	1.0	2.5	0.0	1.9	2.2
	11 – 15-ft	440	160.4	278.3	377.8	750	4.2	6.8	1.0	1.5	0.0	1.8	3.6
	16-ft & over	63	149.8	273.6	391.3	900	4.6	2.5	1.3	2.5	0.0	0.0	0.0
Disk harrow, tandem, horse-drawn	7-ft	18	49.8	103.6	389.8	250	2.9	23.5	1.0	5.8	0.0	0.0	17.7
	8 – 9-ft	39	66.1	92.3	185.6	400	6.0	10.0	1.0	0.0	0.0	0.0	10.0
	10-ft & over	38	47.5	91.2	122.0	270	4.7	12.0	1.0	0.0	0.0	0.0	12.0
Disk harrow, tandem, tractor-drawn	7-ft	79	108.4	159.4	254.1	600	3.8	7.0	1.0	1.4	0.0	2.8	2.8
	8-ft	114	96.5	203.8	236.9	600	4.6	14.2	1.0	3.3	0.0	5.5	5.5
	9-ft	18	109.0	175.4	158.3	400	2.7	5.9	1.0	5.9	0.0	0.0	0.0
	10-ft & over	200	130.4	206.9	327.0	960	2.9	7.1	1.0	1.9	0.0	1.9	3.4
Spike-tooth harrow, horse-drawn	7 – 11-ft	222	49.1	69.0	148.9	700	1.7	4.4	1.0	1.1	0.0	0.0	3.3
	12 – 15-ft	405	83.8	103.0	160.9	450	3.9	4.3	1.0	0.1	0.0	0.3	2.8
	16 – 19-ft	293	106.2	142.0	237.4	600	1.4	1.7	1.2	0.0	0.0	0.0	1.7
	20-ft & over	500	140.6	211.7	386.6	800	1.3	2.8	1.1	0.6	0.0	0.8	1.4
Spike-tooth harrow, tractor-drawn	15-ft & under	147	116.7	160.4	357.0	800	5.7	7.7	1.0	2.8	0.0	3.8	1.8
	16 – 19-ft	183	154.6	227.5	300.4	1,002	7.2	6.7	1.1	6.7	0.0	0.0	0.6
	20-ft & over	791	157.4	249.4	371.1	1,000	4.8	5.6	1.0	1.1	0.0	1.1	3.4
Spring-tooth harrow, horse-drawn	9-ft & under	30	30.5	49.9	66.1	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10-ft & over	42	45.3	69.2		222	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spring-tooth harrow, tractor-drawn	7 – 9-ft	106	52.5	84.1	106.6	240	4.6	5.4	1.0	2.2	0.0	1.1	2.1
	10-ft & over	112	50.5	127.3	186.4	800	2.3	1.2	1.0	1.2	0.0	0.0	0.0
Roller, horse-drawn	8-ft & under	33	42.2	46.8	64.8	205	10.0	17.4	1.0	0.0	0.0	0.0	17.4
	9-ft & over	62	42.2	85.7	102.3	550	18.3	16.2	1.0	4.6	0.0	0.0	11.6
Roller, tractor-drawn	12-ft & under	114	131.1	113.8	128.8	951	31.2	22.8	1.1	14.5	0.0	0.0	6.0
	13-ft & over	98	96.8	163.9	229.3	300	33.5	26.9	1.0	13.5	0.0	1.5	11.9
Grain drill, horse-drawn	7-ft	74	28.7	35.7	43.4	112	15.7	17.5	1.0	3.4	0.0	1.8	12.3
	8 – 9-ft	110	20.7	30.1	44.8	100	24.9	16.5	1.0	2.4	0.0	3.5	10.6
	10 – 11-ft	49	27.5	41.8	41.5	137	35.3	21.1	1.0	2.6	0.0	2.6	15.9
	12-ft & over	18	35.3	51.7	94.5	104	11.6	8.3	1.0	0.0	0.0	0.0	8.3
Grain drill, tractor-drawn	7-ft	14	20.0	68.9	116.2	125	27.9	25.0	1.0	8.0	0.0	0.0	17.0
	8 – 9-ft	25		45.2	64.3	215	28.7	9.5	1.1	4.7	0.0	4.8	0.0
	10 – 11-ft	36	41.8	54.7	64.9	210	23.6	17.4	1.0	13.1	0.0	0.0	4.3
Corn planter, horse-drawn	2-row	2,486	33.0	52.9	91.3	315	7.0	8.5	1.1	2.1	0.2	0.6	5.4
Corn planter, tractor-drawn	2-row	109	54.1	85.5	129.2	280	9.6	12.0	1.2	4.0	10.0	10.1	6.0
	4-row	25	128.6	198.2	252.6	450	30.6	5.0	1.0	0.0	0.0	5.0	0.0
Cultivator, horse-drawn	1-row	2,188	52.6	61.3	74.3	366	1.6	4.4	1.0	0.5	0.3	0.5	3.1
	2-row	537	79.5	99.9	118.1	660	2.2	4.1	1.0	0.2	0.0	1.8	2.0
Cultivator, tractor-drawn	2-row	1,512	115.0	190.1	277.3	1,400	4.2	9.9	1.1	2.1	0.1	3.0	4.9
	4-row	25	198.0	367.8	561.8	1,200	8.2	5.0	1.0	0.0	0.0	5.0	0.0
Mower, horse-drawn	5-ft	1,266	23.5	30.4	50.5	400	4.6	6.8	1.2	1.5	0.0	1.3	4.0
	6-ft	1,012	29.1	41.2	64.1	429	5.8	9.7	1.6	3.0	0.0	1.3	5.4
	7-ft	46	21.0	39.2	56.9	200	2.2	14.9	1.5	3.7	0.0	0.0	9.3
Mower, tractor-drawn	5 – 6-ft	67	38.3	47.2	70.0	210	9.5	15.9	1.0	4.1	0.0	3.0	8.7
	7-ft	160	69.3	83.9	101.3	690	11.1	17.4	1.2	5.8	1.4	3.8	6.4
Rakes, horse-drawn	Dump	903	27.9	34.4	51.7	400	10.8	9.4	1.1	2.6	0.0	1.0	5.8
	Side-del.	656	32.7	44.7	61.8	300	9.6	14.5	1.0	6.8	0.0	1.1	6.6
	Sweep	38	26.1	35.5	45.5	120	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rakes, tractor-drawn	Dump	13	51.4	59.3	100.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Side-del.	50	62.7	91.1	120.4	600	13.8	30.0	1.0	10.0	0.0	2.0	18.0
Grain binders, horse-drawn	6-ft	159	20.6	24.5	40.3	100	9.4	8.4	1.2	1.4	0.0	2.1	4.9
	7-ft	157	22.6	33.9	26.9	130	17.4	13.5	1.2	4.7	0.0	2.7	6.1
	8-ft	560	28.1	42.4	60.5	135	11.6	13.1	1.1	2.5	0.4	4.2	5.8
	9 – 10-ft	22	22.4	25.2	20.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grain binders, tractor-drawn	6-ft	45	33.7	45.2	44.0	80	36.8	22.0	1.2	12.2	0.0	4.9	4.9
	7-ft	51	15.0	36.3	58.3	80	16.5	14.0	1.0	0.0	0.0	8.0	6.0
	8-ft	475	31.4	56.5	79.5	180	14.2	15.4	1.1	4.4	2.1	5.0	5.7
	9 – 10-ft	249	60.3	71.3		300	11.2	25.7	3.5	10.9	0.0	6.1	8.7
Combines	4-ft & under	16	69.3	70.5	81.2	150	24.5	40.0	1.8	6.7	6.7	26.6	0.0
	5-ft	72	174.5	166.3	182.4	340	60.9	77.8	5.2	16.5	2.9	58.4	0.0
	6-ft	92	219.5	201.8	204.0	940	58.3	72.1	4.0	14.6	6.8	48.5	2.2
Corn pickers	1-row	162	61.9	68.2	100.0	328	20.2	29.4	1.5	11.1	8.7	8.7	0.8
	2-row	366	143.4	162.9	171.3	710	38.9	57.4	2.4	18.4	7.9	28.4	2.7

*Once-over acres.

**Because some machines were used on other farms on more than one basis, the figures in this column are in some cases not equal to the sums of those in the last four columns.

†For those machines used on other farms.

††Includes those cases where only the machine is rented as well as the usual custom work where operators and power units are furnished.

TABLE 3. USE OF FIELD MACHINES ON DIFFERENT SIZED FARMS IN IOWA IN 1941
(DATA OBTAINED FROM SAMPLES IN TABLE 1)

Machine	No. of machines in sample	Range of farm sizes, acres	Avg. total annual use, acres	Avg. annual use on other farms, %	Machines used on other farms*, %	Terms of use on other farms			
						Partnership, %	Exchange %	Custom, %	Loan, %
Plow,	9	0 - 40	15.8						
two-	271	41 - 120	47.2	15.5	14.8	4.3		5.7	4.8
bottom,	632	121 - 200	62.2	6.1	6.7	1.2		2.4	3.0
tractor-	267	201 - 280	79.1	3.2	7.6	0.5		3.0	4.1
drawn	142	281 - 360	109.8	0.8	5.6			0.9	4.7
	84	361+	129.2						
	1405	All	70.7	5.2	7.9	1.6		3.2	3.9
Corn	54	0 - 40	15.1	34.3	11.8	3.9			7.9
planter,	712	41 - 120	34.4	14.8	10.3	1.8	0.4	0.9	7.2
two-row	1016	121 - 200	51.3	5.3	7.0	2.5		0.7	3.8
horse-	395	201 - 280	66.9	5.2	8.4	1.6		0.3	6.5
drawn	204	281 - 360	89.6	4.4	8.9	2.1	0.5	1.6	4.7
	105	361+	92.6	4.1	8.2	1.0		1.0	6.2
	2486	All	52.9	7.0	8.5	2.1	0.2	0.6	5.4
Corn	1	0 - 40	8.0						
planter,	19	41 - 120	56.5	29.7	10.5	3.5		0.4	3.5
two-row,	29	121 - 200	66.0	16.7	19.2	7.7	3.8		7.7
tractor-	25	201 - 280	80.5	5.5	8.7				8.7
drawn	12	281 - 360	97.5						
	23	361+	140.8	3.3	9.1	4.6			4.6
	109	All	85.5	9.6	12.0	4.0	10.0	10.1	6.0
Cultivator,	8	0 - 40	34.8†	12.6	20.0			20.0	
two-row,	176	41 - 120	81.6	1.3	4.7	0.78		1.6	2.3
horse-	220	121 - 200	102.3	3.4	3.0			1.2	1.8
drawn	65	201 - 280	132.8						
	43	281 - 360	139.4	1.5					
	25	361+	81.5	5.6	23.5			11.8	11.8
	537	All	99.9	2.2	4.1	0.25		1.8	2.0
Cultivator,	8	0 - 40	99.0†	19.4	75.0	25.0		25.0	25.0
two-row,	276	41 - 120	118.3	10.0	11.5	1.8		3.7	6.0
tractor-	619	121 - 200	177.2	5.4	10.4	2.4	2.0	3.1	4.9
drawn	310	201 - 280	203.9	2.3	9.9	1.8		2.7	5.4
	177	281 - 360	269.7	1.3	6.7	1.5		2.2	3.0
	122	361+	288.3	1.6	8.1	2.3		2.3	3.5
	1512	All	190.1	4.2	9.9	2.1	0.08	3.0	4.9
Corn		0 - 40							
picker,	28	41 - 120	61.9	35.5	54.2	20.9	12.5	20.9	
one-row,	75	121 - 200	61.3	22.7	33.3	13.0	13.0	7.4	
tractor-	36	201 - 280	65.6	11.0	10.7	7.1		3.6	
drawn	15	281 - 360	61.0	8.7	7.7		7.7		
	8	361+	173.2	13.3	28.6			14.3	14.3
	162	All	68.2	20.2	29.4	11.1	8.7	8.7	0.8
Corn	2	0 - 40	118.0	38.1	50.0		50.0		
picker,	36	41 - 120	144.8	54.4	59.4	25.5	5.6	28.3	
two-row,	123	121 - 200	164.7	49.6	69.4	22.8	10.1	34.7	1.8
tractor-	80	201 - 280	156.4	41.0	62.7	18.5	4.3	37.1	2.9
drawn	73	281 - 360	170.6	31.8	48.4	16.1	10.3	19.1	3.0
	52	361+	172.3	13.4	31.8	6.4	4.2	14.9	6.4
	366	All	162.9	38.9	57.4	18.4	7.9	28.4	2.7
Mower,	23	0 - 40	26.9	50.2	36.4	13.6		4.6	18.2
6-ft,	243	41 - 120	29.4	9.2	8.1	1.8		1.4	4.9
horse-	424	121 - 200	37.4	5.6	9.5	3.5		1.5	4.5
drawn	159	201 - 280	47.7	3.6	8.7	2.7		0.7	5.4
	94	281 - 360	67.7	3.3	9.5	2.4		1.2	5.9
	69	361+	59.3	1.3	7.6	1.5			6.1
	1012	All	41.2	5.8	9.7	3.0		1.3	5.4
Mower,		0 - 40							
7-ft,	19	41 - 120	69.3	25.2	27.8	11.1	5.6	11.1	
tractor-	41	121 - 200	63.1	16.2	23.7	8.9	2.6		13.1
drawn	38	201 - 280	84.0	13.7	17.6	2.9			14.7
	32	281 - 360	70.9	5.9	6.7	2.2		4.5	
	30	361+	131.8	4.2	13.8	6.9		6.9	
	160	All	83.9	11.1	17.4	5.8	0.1	3.9	6.4
Grain	5	0 - 40	10.8	77.8	20.0	100.0			
binder,	125	41 - 120	28.9	17.0	14.8	4.4	0.9	1.8	7.8
8-ft,	263	121 - 200	41.2	10.7	12.8	2.5		5.0	5.4
horse-	100	201 - 280	52.3	13.0	15.1	1.2	1.2	5.8	7.0
drawn	42	281 - 360	62.4	4.6	7.9			5.3	2.6
	25	361+	56.9	8.3	10.0			5.0	5.0
	560	All	42.4	11.6	13.1	2.5	0.4	4.2	5.8
Grain		0 - 40							
binder,	72	41 - 120	33.4	31.2	17.4	2.9		5.8	8.7
8-ft,	213	121 - 200	50.4	13.4	15.3	5.7	2.1	4.3	4.7
tractor-	112	201 - 280	68.0	16.6	17.3	3.8		5.6	7.9
drawn	51	281 - 360	78.8	10.9	12.8	4.3		6.4	2.1
	28	361+	80.7	12.4	8.0			4.0	4.0
	475	All	56.5	14.2	15.4	4.4	2.1	5.0	5.7
Combine,		0 - 40							
4-ft and	3	41 - 120	69.3	34.6	100.0	50.0	50.0		
less	4	121 - 200	64.8	37.0	50.0			50.0	
	4	201 - 280	63.8	18.8	25.0			25.0	
	3	281 - 360	62.0	32.2	33.3			33.3	
	2	361+	110.0						
	16	All	70.5	24.5	40.0	6.7	6.7	26.6	
Combine,	1	0 - 40	380.0	98.6	100.0			100.0	
5-ft	9	41 - 120	151.7	69.2	88.9	29.6		59.2	
	27	121 - 200	143.5	63.6	83.3	20.8	4.2	58.3	
	12	201 - 280	174.9	63.6	80.0	8.9		71.1	
	17	281 - 360	199.9	56.5	76.9	7.0	7.0	62.9	
	7	361+	140.0	35.2	33.3	16.7		16.7	
	73	All	166.3	60.9	77.8	16.5	2.9	58.4	
Combine,		0 - 40							
6-ft	13	41 - 120	193.5	78.0	77.0	15.4	7.7	61.6	
	30	121 - 200	231.1	59.3	79.3	23.2	13.2	42.9	
	26	201 - 280	190.8	50.2	64.0	7.5	3.8	48.9	3.8
	13	281 - 360	149.1	40.8	63.7	9.1		45.5	9.1
	10	361+	223.3	65.3	75.0	12.5		62.6	
	92	All	201.8	58.3	72.1	14.6	6.8	48.5	2.2

*Because some machines were used on other farms on more than one basis, the figures in this column are in some cases not equal to the sums of those in the last four columns.

†Once-over acres.

A.S.A.E. Honor Roll

MORE THAN ten per cent of the members of the American Society of Agricultural Engineers are now on active duty with the armed services of the United States and its United Nations allies. The Society is proud of these members and devoutly wishes them Godspeed in the grand service they are rendering their country and humanity in the greatest world crisis known to man.

Listed on this page are the names of those active members who are definitely known to be in war service, according to the records of the secretary of the Society. Information will be welcome covering (1) additions to the list, (2) promotions in rank, and (3) changes or corrections in branch of service, unit, etc. Such information should be reported promptly and should be addressed to Secretary, A.S.A.E., St. Joseph, Michigan. This list, with additions and changes, will appear at intervals in AGRICULTURAL ENGINEERING.

M. S. Adams, Lt., 2-D-5th Defense Battalion, USA
J. C. P. Agnew, 2nd Lt., 39th Infantry, USA
Donald A. Anderson, 1st Lt., Ordnance Dept., USA
John M. Anderson, 2nd Lt., Field Artillery, USA
Quincy C. Ayres, Lt. Com., liaison officer, design division, Bureau of Yards and Docks, USN
J. M. Babb, 2nd Lt., Quartermaster Corps, USA
Thomas L. Baggette, Capt., 114th Field Artillery Bn., USA
Ralph W. Baird, Capt., 605th Coast Artillery (Antiaircraft), USA
Samuel J. Baldwin, officer candidate detachment, Antiaircraft Artillery School, USA
Harry R. Ball, Ensign, USNR
Juan Bazo-Fontaneil, Pvt., Air Force, USA
H. E. Bergschneider, Capt., Air Force, USA
Harry E. Besley, Maj., Corps of Engineers, USA
L. W. Bonhorst, Apprentice Seaman, USNR
C. R. Boone, Officer Candidate School, USA
Eugene C. Buie, Capt., 55th Quartermaster Regiment (Heavy Motor Maintenance), USA
B. Gwynne Burr, Lt., 17th Troop Carrier Squadron, USN
G. A. Burson, Jr., Lt., 11th A. R., 10th Division, USA
Elwin D. Butler, 2nd Lt., 156th Infantry, USA
Harold C. Campbell, 2nd Lt., Air Force, USA
R. Barry Cecil, 2nd Lt., Air Force, USA
Frederick C. Chambers, 2nd Lt., Ordnance Dept., USA
Thayer Cleaver, Capt., Coast Artillery (Antiaircraft), USA
Lawrence Collins, Maj., G.S.C., Headquarters Second Armored Div., USA
Stanley A. Collins, Capt., Corps of Engineers, USA
Edward O. Cone, Officer Candidate School, Corps of Engineers, USA
J. E. Cottingham, Jr., 2nd Lt., 126th Infantry, USA
Wansley H. Cox, 2nd Lt., 130th Infantry, USA
Fred M. Crawford, 1st Lt., 75th Coast Artillery (Antiaircraft), USA
Roy D. Crist, Capt., Air Force, USA
Myron G. Cropsey, Capt., Ordnance Dept., USA
George E. Cubberly, 1st Lt., Corps of Engineers, USA
John F. Cykler, Ensign, USN
Samuel A. Dance, 2nd Lt., Air Force, USA
Paul C. Dillon, 1st Lt., 82nd Field Artillery, USA
Arnold A. Dudley, 2nd Lt., 23d Armored Engineers Bn., Corps of Engineers, USA
L. G. Duggar, Capt., Air Force, USA
Richard A. Duncan, Capt., Corps of Engineers, USA
Geo. H. Dunkelberg, 1st Lt., 321st Field Artillery, USA
John F. Eppes, Lt., USA
G. Theon Finlinson, Pvt., Corps of Engineers, USA
George R. Fisher, 2nd Lt., 67th Engineer Co. (Topographical), Corps of Engineers, USA
Julian M. Fore, Lt., USA
Reuben R. Garrard, Aviation Cadet-Engineer, Air Force, USA
Walter E. Garrard, 2nd Lt., Air Force Training Detachment, USA
Stanley B. George, Pvt., Quartermaster Corps, USA
Harold E. Gray, 2nd Lt., Signal Corps, USA
Thomas E. Griffin, 2nd Lt., Signal Corps, USA
Guy W. Halsey, 1st Lt., Air Force, USA
Orville C. Hansen, Lt., 68th Armored Field Artillery, USA
Melvin J. Happe, 2nd Lt., Corps of Engineers, USA
George M. Hardy, Ensign, USNR
H. T. Hargrave, 2nd Lt., Royal Canadian Ordnance Corps
Arlon G. Hazen, 1st Lt., 819th Engineers Bn. (Aviation), Corps of Engineers, USA
G. L. Hazen, 2nd Lt., 17th Armored Engineers Bn., Corps of Engineers, USA
Orve K. Hedden, Maj., 614th Tank Destroyer Bn., USA
Winston H. Hedges, Aviation Cadet, Air Force, USA
Ward H. Henden, 1st Lt., 41st Armored Infantry, USA
Etlar A. Henningsen, 2nd Lt., Field Artillery, USA
Truman E. Hienton, Maj., Ordnance Dept., USA
Edward A. Hodge, 1st Lt., Field Artillery, USA
John W. Holliday, 2nd Lt., Coast Artillery Corps, USA
James T. Hudson, 1st Lt., Signal Corps, USA
John H. Hudson, Air Force, USA
William E. Hudson, 2nd Lt., Troop A, 15th Cavalary, USA
Paul Huey, 1st Lt., Air Force, USA
K. B. Huff, Capt., 303rd Material Squadron, Air Force, USA
Albert F. Keegan, USA
Wesley M. Land, Jr., 2nd Lt., F.A.R.C., USA
Frank B. Lanham, 1st Lt., Coast Artillery, USA
Wharton A. LeBlanc, Capt., Co. F, 9th Infantry, USA
Clark H. Leesman, 2nd Lt., Corps of Engineers, USA
Ray M. Lien, Aviation Cadet, Air Force, USA
Andrew J. Longley, Capt., Cavalry School, USA
Carl J. Lowry, 1st Lt., Corps of Engineers, USA
Fred A. Lyman, 1st Lt., 344th Flexible Gunnery, Air Force, USA
William F. Lytle, Aviation Cadet, Air Force, USA
Robert M. Magee, 2nd Lt., Field Artillery, USA
J. Walter Marquardt, Chief Signal Office, USA
Ludy M. Massie, Pvt., Medical Dept., USA
J. R. McCalmont, Lt., USNR
James E. McCay, 2nd Lt., Air Force, USA
Othie R. McNurry, 1st Lt., Field Artillery, USA
Richard E. Melson, Midshipman, USNR
Linn G. Melvin, Ensign, USN
Fred Meyer, Jr., Pvt., 349th Engineers, USA
Edwin L. Miller, Ensign, USNR
Arthur W. Milliken, Lt. (j.g.), USN
William E. Moore, Jr., Capt., Headquarters Battery, 24th Division Artillery, USA
Howard E. Morrison, Pvt., 131st Engineers, USA
Joseph C. Newell, 2nd Lt., 355th Infantry, USA
Karl H. Norris, Signal Corps, USA
Erling Nossum, Jr., 2nd Lt., Air Force, USA
William J. Oates, 2nd Lt., Infantry Co. D, 57th Training Battalion, USA
Francis X. Olney, Capt., Field Artillery School, USA
Ralph A. Palmer, Maj., Air Force, USA
Robert A. Parmele, 2nd Lt., 37th Armored Regiment, USA
Ben J. Pecena, Pvt., F.H.S. Reception Center, USA
Wiley D. Poole, USA
Thurman P. Powell, Lt., 201st Infantry, USA
John W. Propst, Jr., Lt., 31st Engineers Regiment, USA
Russell H. Reed, Capt., Quartermaster Corps, USA
Thomas L. Reeves, Officer Candidate School, Corps of Engineers, USA
Bernard D. Reynolds, Jr., 2nd Lt., Field Artillery, USA
Charles E. Rice, 2nd Lt., 102nd Cavalry (Mechanized), USA
Joe B. Richardson, 1st Lt., Coast Artillery (Antiaircraft), USA
Herbert S. Riesbol, 1st Lt., Corps of Engineers, USA
June Roberts, Lt. (j.g.), USNR
James B. Robinson, Jr., 2nd Lt., 14th Cavalry, USA
John W. Rockey, Maj., Air Force, USA
Earl J. Rodman, 1st Lt., Infantry, USA
Paul H. Rofkar, 1st Lt., Field Artillery, USA
Charles M. Sanders, 1st Lt., Field Artillery, USA
R. A. Schmidt, Pilot-Officer, Royal Canadian Air Force
Arthur H. Schulz, Pvt., Air Force, USA
Hillard C. Seaton, Armored Forces, R.T.C., USA
James L. Shepherd, 1st Lt., Air Force, USA
Jerome W. Sorenson, Jr., Capt., 142nd Infantry, USA
James P. Stafford, Jr., 2nd Lt., Corps of Engineers, USA
Herbert N. Stapleton, 1st Lt., Coast Artillery, USA
A. H. Stephenson, 1st Lt., Coast Artillery, USA
Homer J. Stockwell, Capt., Air Force, USA
C. M. Stokes, 1st Lt., Field Artillery, USA
Samuel Strebin, USN
Norris P. Swanson, USA
John G. Taylor, USA
H. Raeburn Test, 1st Lt., Air Force, USA
Anthony E. Theisen, Pvt., USA
Harold J. Thompson, 2nd Lt., 472nd Engineering Maintenance Co., USA
Lonnie F. Thompson, 1st Lt., 36th Field Artillery, USA
Donald L. Trapp, Pilot, Royal Canadian Air Force
Robert H. Vahrenkamp, 2nd Lt., Infantry, USA
Richard L. Walker, Capt., Air Force, USA
H. B. Wall, 2nd Lt., 6th Cavalry, USA
William C. Wheeler, 2nd Lt., Infantry, USA
Lowell L. Whitaker, Ensign, USNR
John W. Wolfe, Lt., 32nd Infantry, USA
O. C. Word, Jr., Maj., Infantry, USA
J. R. W. Young, S/Lt., Royal Canadian Navy

Proper maintenance means adequate attention to the details which help assure that a power line will stay on the job, regardless of weather conditions. There must be no failure of power supply to vital war industries or to the farm front.

Proper maintenance means the use of proper materials, correctly installed. Makeshift devices can cause a line to depreciate rapidly, even under normal operating conditions, and to fail without warning. You are permitted to obtain necessary maintenance materials on Government ruling P-46.

Don't think, because you're not seeing as much of the Alcoa representatives as you used to, that they're not interested in your power line work. We're using these men today to help expedite delivery of Aluminum Alloy products to other war industries. But they're available to help on your maintenance and operating problems.

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ON RURAL POWER LINES AND HI-LINES

NEWS

A.S.A.E. Fall Meeting Program Features the Food Front

"AGRICULTURAL ENGINEERS ON THE FOOD FRONT," to use the words of President H. B. Walker, constitutes the central theme of the program of the Fall Meeting of the American Society of Agricultural Engineers to be held at the LaSalle Hotel, Chicago, December 7 to 9.

Meetings Chairman Deane G. Carter, together with a supporting "cast" consisting of D. A. Milligan, chairman of the Power and Machinery Division; M. H. Lloyd, chairman of the Rural Electric Division; S. A. Witzel, chairman of the Farm Structures Division, and Wm. E. Meek, chairman of the Soil and Water Conservation Division has arranged a program that stresses the problems and achievements of agricultural engineers in their efforts to back up the food production front which they feel is second to none in importance in the winning of the war.

The day previous to the opening of the meeting (December 6) will be devoted to meetings of the Society's Council, the Jury of Awards, and the Cabinet. Those members of the Society who usually arrive at the place of meeting the day or evening preceding the opening will be interested to know that three large connecting parlors on the mezzanine floor of the Hotel LaSalle will be open during the afternoon and evening of December 6 so that those arriving early may get together for the usual premeeting confabulations.

The meeting proper opens at 9:30 a.m. Monday, December 7, with concurrent programs featuring power and machinery and farm structures. The Power and Machinery program for this session consists of four papers, one being on rental rates for farm machinery by C. B. Richey of Ohio State University and another on production rating of farms under wartime conditions by Frank J. Zink of the Farm Equipment Institute. Dillon S. Myer, director, War Relocation Authority, will talk on equipment problems in relation to administration of war relocation centers. The Farm Structures program consists of four formal papers, one on progress in the prefabrication of farm structures by J. D. Long of the Douglas Fir Plywood Association, one on the possibilities for standardization of farm structures by Henry Giese of Iowa State College, another on wartime farm construction by C. L. Hamilton of the USDA Division of War Board Services, and the fourth by Hugh Curtis of "Successful Farming" on the needs and opportunities for farm improvements.

The afternoon of Monday, December 7, will be given over to a general session with A.S.A.E. President H. B. Walker presiding. The theme of the session is to be wartime requirements confronting agricultural engineers. President Walker will open the session with a talk on agricultural engineers on the food front. James A. S. Watson, agricultural attache of the British Embassy in Washington, will talk on farm machinery in Britain's food production effort, which will be followed by a presentation of the program of the federal government for rationing of farm machinery and equipment by L. L. Needler, director of the USDA Division of War Board Services. A. W. Turner, chairman of the A.S.A.E. Committee on Wartime Allocation of Farm Equipment, will discuss agricultural engineering viewpoints on farm equipment rationing.

No formal sessions are scheduled for the evenings of December 7 and 8, but instead they will be left free for committees and other groups to schedule round table sessions. The Committee on Hay Harvesting and Storage has already scheduled a round table for the evening of December 7, and the rural electrification group another round table for the evening of December 8. Other groups that desire to get together during the A.S.A.E. meeting should arrange with the Secretary of the Society for time and place of such meetings.

The forenoon of Tuesday, December 8, is to be given over to concurrent programs on rural electrification and soil and water conservation. The Rural Electrification program will open with a paper on wartime rural electrification research by C. W. Wildebour of the Puget Sound Power & Light Co., followed by a paper by Roy W. Godley of the Monongahela West Penn Public Service Co., discussing the program of his company for promoting the care and repair of farm and home equipment. A third paper on the use of electrical equipment for increasing farm production will be presented by Richard Boonstra of the Public Service Company of Northern Illinois. The Soil and Water Conservation program for this period lists the following papers: Irrigation of food-for-victory gardens, by L. H. Schoenleber of Kansas State College; the effect of soybean and corn residues on infiltration, by E. H. Kidder and C. A. Van Doren of the Soil Conservation Service and R. S. Stauffer of the Illinois Agricultural Experiment Station; increased production from improved irrigation practices, by Howard Matson of the Soil Conservation Service; and a bulldozer for general-purpose farm tractors, by Virgil Overholt, C. B. Richey, and L. A. Morehead of Ohio State University.

Three separate programs are scheduled for the afternoon of December 8. During the first half of the afternoon the Power and Machinery program will be presented concurrently with the Farm Structures program. On the Power and Machinery program, H. P. Bateman of the University of Illinois will present a paper on the effect of full loads on farm machine operating economies, and E. C. McKibben of Michigan State College will discuss the overall performance of combinations of implements as affected by the reliability of individual units. These two papers will be followed by a symposium consisting of short contributions on how to reduce labor and power in the production of (1) sugar beets, by E. M. Mervine, USDA; (2) rice, by H. T. Barr and H. A. Kramer, of Louisiana State University; (3) wheat, by F. C. Fenton of Kansas State College; (4) corn, by C. K. Shedd of Iowa State College; (5) cotton, by H. P. Smith of the Texas Agricultural Experiment Station; (6) soybeans, by R. I. Shawl and A. L. Young of the University of Illinois; (7) potatoes, by A. W. Clyde of Pennsylvania State College; (8) hay, by L. A. Brandrup of New Idea, Inc., and (10) flax, by A. J. Schwantes of the University of Minnesota. The Farm Structures program will consist of three papers. H. J. Barre, of the USDA and Iowa State College, will discuss the results of the 1942 emergency grain storage program, the discussion of which will be led by I. D. Mayer of Purdue University. The second paper will be on the causes of barn failures due to wind by C. K. Otis of the University of Minnesota, and the third on increased pork production on concrete by E. L. Hansen of the Portland Cement Association.

Following a half-hour intermission the Power and Machinery program for the afternoon will be continued with a symposium on wartime programs for conservation of farm equipment, which will be opened by a report by S. P. Lyle of the USDA Extension Service on aspects of the 1942-43 nation-wide repair and conservation program, followed by C. N. Turner of Cornell University, who will discuss the statewide farm machinery repair program in New York. D. A. Milligan, chairman of the A.S.A.E. Committee on Farm Machinery Conservation, will discuss industry activity in the field of machinery conservation. The session will then be open for general discussion. Concurrently with this program will be one on Rural Electrification featuring the subject of feed and food dehydration, the papers being as follows: The dehydration of sweet potatoes for livestock feed, by Ray Crow of Tennessee Coal, Iron, and Railroad Co.; Nebraska type homemade food driers, by Miss Ruby M. Loper and F. D. Yung of the University of Nebraska; food dehydration work in Ohio, by W. A. Junnila of the Ohio Agricultural Experiment Station; community fruit and vegetable dehydrators, by J. A. Schaller of the Tennessee Valley Authority; performance of small domestic dehydrators, by L. W. Gray of the Georgia Power Co.; and electric drying of fruits and vegetables, by G. J. Burkhardt and A. V. Krewatch of the University of Maryland.

During the forenoon of Wednesday, December 9, a joint program on Farm Structures and Rural Electrification will run concurrently with the program on Soil and Water Conservation. The former will feature the subject of blackout requirements for dairy barns and poultry houses, with H. E. Pinches of the University of Connecticut speaking on East Coast conditions, C. P. Wagner of Northern States Power Co. on Middle West conditions, and J. R. Tavernetti and H. L. Belton of the University of California on Pacific Coast conditions. Following this there will be a symposium

(Continued on page 364)

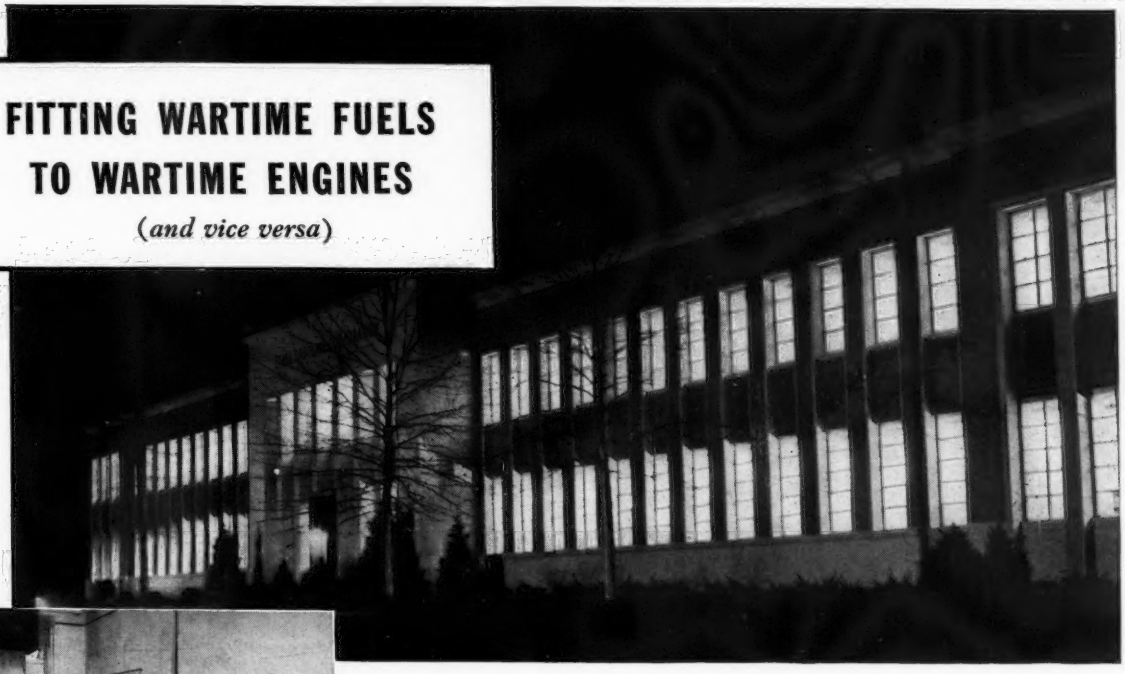
A.S.A.E. Meetings Calendar

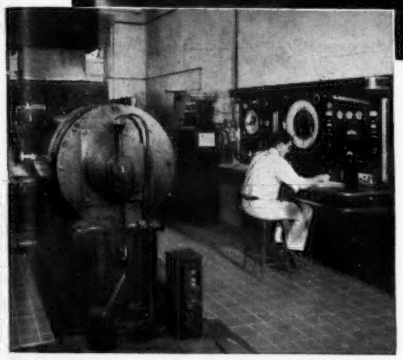
December 7 to 9—Fall Meeting, LaSalle Hotel, Chicago

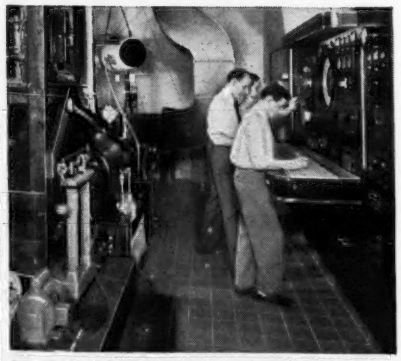
June 21 to 23—Annual Meeting, Purdue University, Lafayette, Ind.

FITTING WARTIME FUELS TO WARTIME ENGINES

(and vice versa)







The impact of war has emphasized the need for correlating fuel and engine research—has brought more sharply to the attention of American engineers that the many individual and specialized problems of fuels and engines are in reality only part of a single problem.

That basic problem is the securing of more power, more work from each drop of fuel consumed and each ounce of metal used in the construction of a given engine.

For many years Ethyl engineers have cooperated with the technologists of the petroleum, automotive and aviation industries in the development of fuels and engines in terms of each other. Today, the new Ethyl Laboratories offer vastly more extensive facilities—some of which are pictured here—for the continuation of this work.

Since winning the war is the prime job of every American, this research work is now devoted largely to engines and fuels for airplanes and other motorized military equipment. It is our objective to explore, in so far as we are able, every means of increasing the power, economy and reliability of the machines which our fighting men use in battle.

ETHYL

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GIVE HIM the "machine guns" in your county

Hundreds of machine guns and many other war-winning weapons can be made from the *tons upon tons* of scrap metal in your county. This precious scrap is lying around on farms and in the backyards of farm equipment distributors and dealers.

To produce new steel for tanks, guns, shells and ships, scrap iron and pig iron must be mixed *half and half*. And America must have these weapons to win.

HOW CAN YOU HELP?

Whether you're in educational work, farming, or are connected with a farm equipment company, your experience can be invaluable to your county Salvage Committee. Urge the dealers and farmers you contact to turn in their scrap. (Steel scrap collected will be purchased by the steel industry at prices set by the Government.)

WAR REACHES YOUR COUNTY

You've seen sons, husbands, brothers and friends go from your county. Many, many more will soon be called into the Service. The quicker our country wins, the more will come back. Get in the scrap *fast*. The American Rolling Mill Company, 3231 Curtis St., Middletown, Ohio.

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The Army-Navy "E" pennant flies from the staff at all Armco *plants—a constant reminder to every* Armco *man and woman of honors won and responsibilities to be met.*

• This advertisement is in support of the Salvage Program of the Conservation Division of the War Production Board

NEWS

(Continued from page 362)

on mow curing of hay, with prepared discussions by G. R. Shier of Ohio State University; J. H. Ramser of University of Illinois; L. L. Koontz of Appalachian Power Co. and Nolan Mitchell of Tennessee Valley Authority; J. B. Stere of West Penn Power Co., and R. C. Miller of Ohio State University. The session will be rounded out by F. W. Duffee of the University of Wisconsin on recent developments in forage harvesting. The Soil and Water Conservation program will feature a paper by J. T. Copeland of Mississippi State College on the principles and advantages of a unified terracing procedure for federal and state agencies; an address by H. H. Bennett, chief of the U. S. Soil Conservation Service, on what is happening to soil conservation methods during the war period; and a paper on the planning of farms for management of runoff water by Marion W. Clark of the University of Missouri.

The final period of the meeting, Wednesday afternoon, December 9, will be devoted to a general session with A.S.A.E. President H. B. Walker presiding. The general theme of the session will be new crops to meet wartime needs, with special attention to production and processing problems. R. B. Gray of the USDA will discuss machinery problems in the production of rubber-bearing plants. This will be followed by an address on the wartime responsibilities of agricultural engineers by Leonard J. Fletcher of the Caterpilar Tractor Co. Harry Miller of the Doane Agricultural Service will discuss problems incident to castor bean production and processing, and Wm. E. Meek of International Harvester Co. will talk on machinery problems in the expanded peanut production program.

It is recommended that those who plan to attend the meeting make their hotel reservations early, and these reservations should be made direct with the LaSalle Hotel, Chicago. Further information regarding the program, requests for room facilities for holding round tables or other group meetings, etc., should be addressed to Secretary A.S.A.E., St. Joseph, Michigan.

Ag Engineers on Rubber Project

THREE members of the American Society of Agricultural Engineers have been assigned to the Guayule Emergency Rubber Project at Salinas, Calif., which is in charge of the Forest Service of the U. S. Department of Agriculture.

S. W. McBirney, senior agricultural engineer, Bureau of Agricultural Chemistry and Engineering, has been transferred from the sugar beet machinery project at Davis, Calif., to head up a project on the development of field machinery for the production of the guayule shrub, which is being expanded as an emergency source of rubber. The B.A.C.E. has been asked to assist with the development of field machinery which will be suitable for the large-scale

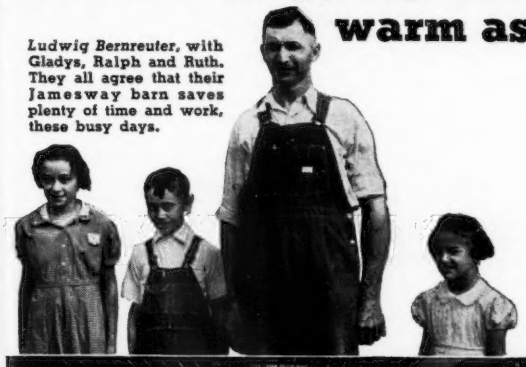
(Continued on page 366)

ART TURNER DIRECTS TRACTOR SCHOOL PROGRAM

In addition to the 13 motor mechanics schools inaugurated for the Canadian Army in April 1941 by the International Harvester Co., under the supervision of Arthur W. Turner, educational adviser, as a contribution to Canada's war effort, Mr. Turner directed the establishment recently of special tractor operation and maintenance schools for the Royal Canadian Air Force at Lethbridge, Alta., and Hamilton, Ont. In the picture Mr. Turner (extreme right) is shown, at R.C.A.F. headquarters in Ottawa, accepting for his company, from Air Commodore R. R. Collard (center), the responsibility for organizing and conducting the automotive courses for the R.C.A.F.

"It's as handy, dry and warm as A NEW BARN

yet part of it is 50 YEARS OLD!"



Ludwig Bernreuter, with Gladys, Ralph and Ruth. They all agree that their Jamesway barn saves plenty of time and work, these busy days.

That's what *Ludwig Bernreuter, Vassar, Mich.* says of his barn remodeled by JAMESWAY. "I have all the advantages of the finest new barns — and saved a lot of money through JAMESWAY planning."

(Above) The clean, Jamesway Iron-clad interior. Jamesway lever stalls lock a whole row of cows at one time. And see that time-saving tub truck!

Part of this barn was built 50 years ago. The present roof, Jamesway ventilator and litter carrier are 30 years old. Outside and inside remodeled with Iron-cladding and insulated. Not a water cup froze last winter—with only 18 cows in that big barn!

50,000 FARMERS ARE GLAD
They Went JAMESWAY, *All the Way*

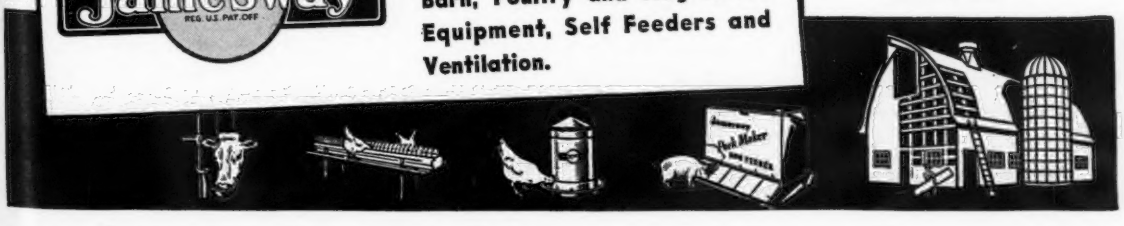
Mr. Bernreuter is one of an army of practical, successful farmers Jamesway has helped plan and equip barns and other farm buildings. Many of them own Jamesway equipment that's 10 — 15 — 20 years old or more, and still giving good service. You can bet they're glad today they have that rugged, dependable Jamesway equipment to see them through!

New equipment is scarce, because war needs come first. James plants are now pouring out goods for the armed forces. But one of these days new, improved Jamesway equipment will again be available. Farmers are planning NOW to make their buildings handier, more comfortable, more profitable. They're saving with War Bonds, to some day make their farms Jamesway all the way.

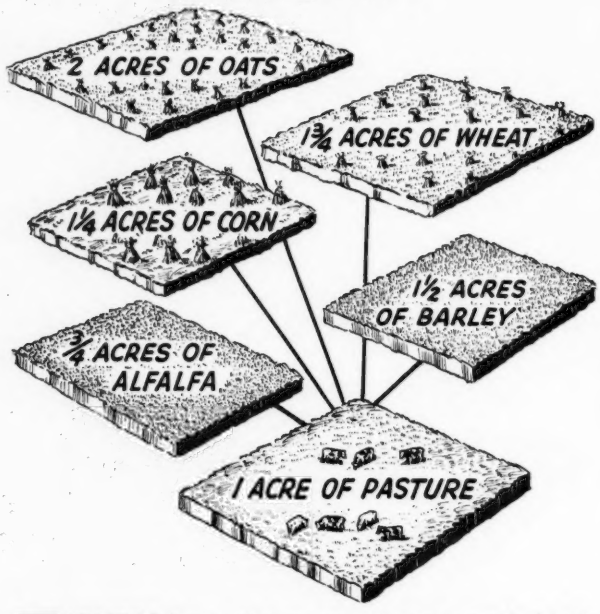
Jamesway
TRADE MARK
REG. U.S. PAT. OFF.

ALL THE WAY . . .
Barn, Poultry and Hog House Equipment, Self Feeders and Ventilation.

JAMES MFG. CO.
Dept. A-1142
Ft. Atkinson, Wis. Elmira, N. Y.
Oakland, Calif.



What's an acre of good pasture Worth?



FARMERS know what an acre of oats is worth, but do they know that an acre of good pasture may be worth twice as much and can yield double the amount of feed for livestock? Only two commonly grown crops . . . corn silage and alfalfa hay . . . can outyield pasture in nutrients. Experiment station tests reveal that it takes 1¾ acres of wheat, 1½ acres of barley or 1¼ acres of corn (for grain) to equal an acre of pasture.

Remember, less labor and expense is required when livestock do the harvesting. Pasture can make about as much money per acre as cultivated grain crops and, at the same time, build soil fertility with deep-rooted legumes. Pasture should be included in regular crop rotation . . . corn, oats, hay — and then a year of pasture.

If additional fencing is required to make the best use of land, consider it an investment even more important than buildings. In choosing a fence for your land improvement program, consider its construction features and lasting qualities, not just its first cost. It pays to buy the best.

CONTINENTAL FENCE is made from extra high tensile strength copper-bearing steel wire with a zinc coating that is FLAME-SEALED . . . actually welded to the steel for greater rust resistance and longer life. It has the famous PIONEER double-grip knot or the CHAMPION hinge joint knot.

CONTINENTAL STEEL CORP., Kokomo, Indiana
Plants at Canton, Kokomo, Indianapolis

CONTINENTAL SUPERIOR STEEL
CONTINENTAL STEEL CORPORATION
15 Types of Farm Fence Posts, Gates, Barb Wire | 14 Styles of Steel Roofing and Siding, and Fittings | Nails Staples, Lawn Fence, Wire Products

NEWS

(Continued from page 364)

and rapid expansion program which is being carried out. The B.A.C.E. will also carry on investigations into the chemistry phases of processing the extraction of rubber from the shrub, and the Bureau of Plant Industry is to carry on investigational work into the plant phases.

R. E. Jezek, formerly connected with the B.A.C.E. project on corn production equipment at Iowa State College, and W. J. Welker, agricultural mechanics instructor at California Polytechnic Institute, have been appointed to assist Mr. McBirney.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Walter J. Andree, manager of merchandising, Sinclair Refining Co., 630 Fifth Ave., New York, N. Y.

Etlar A. Henningsen, 2nd Lt., Co. A, 776th Tank Destroyer Bn., U. S. Army. (Mail) Dike, Iowa.

Dale E. Kirk, assistant agricultural engineer, Oregon State College, Corvallis, Ore. (Mail) 330 N. 30th St.

Paul M. Mulliken, executive secretary, National Retail Farm Equipment Association, St. Louis, Mo. (Mail) 207 Hotel DeSota Bldg.

J. Howard Pile, vice-president and editorial director, The Chek-Chart Corp., 624 S. Michigan Ave., Chicago, Ill.

William J. Ridout, Jr., rural electrification extension specialist, Clemson College, S. C. (Mail) P. O. Box 375.

Herbert Samek, assistant to the chief engineer, David Brown Tractors Ltd. (Mail) 8 Newton Flats, Fitzwilliam St., Huddersfield, Yorks, England.

Don D. Smith, fire protection engineer, R. A. Rowan & Co. (Mail) 11914 Weddington St., North Hollywood, Calif.

John Wright, Jr., instructor in agricultural engineering, N. Y. State Institute of Agriculture, Farmingdale, L. I., N. Y.

TRANSFER OF GRADE

Elmer F. Clark, agricultural engineer, farm equipment division, Butler Mfg. Co., Kansas City, Mo. (Mail) 218 W. Farmer. (Junior

Duty of Field Machines

(Continued from page 357)

To obtain the maximum daily performance of a complicated machine, particularly where it is being used in conjunction with one or more other machines, requires a very high quality of management. In fact, it is not at all uncommon for the daily performance of certain machines to be as low as 50 per cent of their theoretical capacity calculated on the basis of width and operating speed.

In view of these limitations, what is the practicable duty of a field machine? This is obviously a question for which there is no positive answer, but it would appear probable that for most of the machines annual duties of 150 to 200 per cent of the average annual use given in Table 2 should be both feasible and economic.

Where farms are larger and topography is favorable, careful management should result in even higher annual duties. On the other hand, a farm operator should not expect to equal the maximum annual accomplishments listed in Table 2, which are in most cases undoubtedly the result of an unusually fortunate combination of a number of favorable circumstances.

The possibility for improvement over the average duty reported is probably not so great for 5 and 6-ft combines and two-row corn pickers, where programs of extensive custom operation are already the rule as shown by the data in Table 2.

Indeed this possibility of custom use probably offers the best possibility of extending the average annual duty of our field machines. The data of Table 2 indicates too great a tendency for machines to be *(Continued on page 368)*

"Oh Tom, if you'd only fixed it last fall we wouldn't be in this fix now!"

Next spring, when *every working machine* will be worth its weight in gold, DON'T be caught unprepared. This winter every farm equipment dealer will be *swamped with service work.*

Pledge your working tools to Victory by signing up with your implement dealer *now.* Get in line—to make sure that every machine and tool you have is *ready for its job in 1943.*

Stick to Your FARM EQUIPMENT Dealer

REPAIR NOW FOR A YEAR THAT WILL BE TOUGH!

NO MAN can kid himself about the new year that is coming up. It will be a hard year—tough and *dangerous* for the Armed Forces—tough to work out here at home.

Every farmer wants to make good in a big-production year for Agriculture. His own livelihood demands it, and the life of the nation is at stake. He knows that manpower will be short beyond all past experience. He knows that new machines will be very scarce and hard to get.

What can he do to prepare? *What can YOU do?* that's what counts, the nation over!

The most practical thing that you can do is to put every piece of your equipment in shape for its maximum use when the time comes. Go over your machines NOW, while all your needs are fresh in mind. List the worn parts; itemize the work needed; check up on all service weaknesses in your tractor, machines, and tools; put workable, discarded implements back on the job. Dedicate your equipment—Pledged to Victory!

Post this 11 x 14-inch sign, in patriotic colors, at your farm gate. Get it from your McCormick-Deering dealer.

The first step to take is to Sign Up with your experienced FARM EQUIPMENT Dealer. He is fully qualified to put the *best possible performance* back on your fields. He knows each operation and adjustment, he has the tools and the expert knowledge. He will have the parts *if you give him time*....Talk over your needs with him. Get in line on his order books—so that you can count on getting the parts and be certain that all repair work is done when the season opens.

It will be the heaviest farm service winter in history. Thousands of forehanded farmers are already beating paths to the service shops of *the men who know how.* They are easing their minds on the prime essential to next year's operations.

The least, and the *first,* thing you can do is to consult your FARM EQUIPMENT Dealer. His job is Service for the duration, *and first-come first-served!*

Write the address below for the practical booklet "Your Farm Equipment —Take Care of It and Make It Do!"

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue, Chicago, Illinois

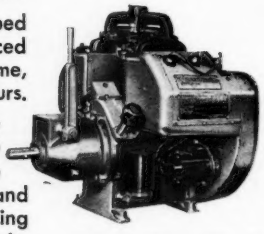
INTERNATIONAL HARVESTER

NO Water Load to Carry...

Every gallon of water you put into the cooling system of an engine ADDS 10 POUNDS to its weight. 5 gals. = 50 lbs.

Every gallon of water pumped and delivered must be replaced periodically . . . consuming time, power and fractional man-hours.

Equipment powered by WISCONSIN AIR-COOLED ENGINES provides complete freedom from water chores and water avoirdupois . . . improving mobility as well as reducing maintenance and servicing burden.



AIR-COOLED

Model VE-4, V-type, 4 cylinder, 22 hp., air-cooled Wisconsin Engine. Weight: 285 lbs.

Trifles, in the aggregate, loom BIG in today's program of vital conservation.

WISCONSIN MOTOR Corporation
MILWAUKEE, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

FOR VICTORY

BUY UNITED STATES WAR BONDS AND STAMPS

This Space is a Contribution to Victory
by AGRICULTURAL ENGINEERING

Duty of Field Machines

(Continued from page 366)

loaned rather than rented. In this connection, farmers have in general held two contradictory views; first, that a neighbor who borrowed machines was a "sponger", and, second, that a farmer who charged for the use of a machine was a "skinflint". These ideas have rather effectively prevented extensive hiring or renting of machines.

There is definite need for a program of education in the cost of use of field machines and for the establishment of recognized fair charges for the hire or custom operation of these machines.

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

AGRICULTURAL ENGINEERS wanted. ASAE headquarters understand that one of the Bureaus of the USDA is greatly in need of agricultural engineers. They can use two or three engineers each of the Junior and Assistant grades, and will probably need more at a later date. If interested, write ASAE, St. Joseph, Mich.

DESIGN ENGINEER capable of original design of farm machinery and related lines, or a man capable of developing into a real design engineer, is wanted by a well-known manufacturer of farm machinery and other equipment. Persons interested are requested to write giving full particulars regarding technical training and experience and other pertinent information. PO-140

GRADUATE ASSISTANTSHIP open in the Pacific Northwest; may be used in the field of farm structures, farm machinery, farm power, rural electrification, or land development. This fellowship provides a stipend of $450 a year on a 9-month basis, requiring about one-third the student's time for teaching and laboratory assistance in elementary engineering subjects. It may be used over a 2-year period for graduate study leading to a master of science degree in agricultural engineering. Applicants should write Hobart Beresford, head, agricultural engineering department, University of Idaho, Moscow.

AGRICULTURAL ENGINEER wanted to fill position offering $2100 to $2500 per annum for duration of war. Combined teaching and research in agricultural engineering in the field of farm structures, graphic presentation, storage, refrigeration, and related subjects is covered by the opening. Applicants should submit with first letter complete personal record with recent photograph to Hobart Beresford, head, department of agricultural engineering, University of Idaho, Moscow.

AGRICULTURAL ENGINEER wanted to fill position open in northeastern university due to absence of staff member in military service. Work involves approximately half extension and half resident instruction. Major concentration in farm structures and soil and water conservation. Salary up to $3000 for qualified person. PO-137

POSITIONS WANTED

AGRICULTURAL ENGINEER with B. S. degree in agricultural engineering from Iowa State College. Has four years' experience as engineer with the Soil Conservation Service and five years' experience as state agricultural conservation engineer for the Agricultural Adjustment Administration. Experienced both in engineering and administration. Thirty-two years of age, married and have family. References upon request. PW-348

AGRICULTURAL ENGINEER with B. S. degree in engineering and M. S. degree in agricultural engineering. Experienced in college teaching, experiment station, and extension work; also factory and construction work. Especially qualified for college agricultural engineering, manufacturing, defense, construction, or trade extension work. Age above draft. PW-346